

2002

Bottomfish and Seamount Groundfish Fisheries of the Western Pacific Region

2002 Annual Report



Western Pacific Regional
Fishery Management Council
1164 Bishop Street, Suite 1400
Honolulu, Hawaii 96813

Cover photo: Bottomfish of Hawaii (from Top to Bottom): *Opakapaka* (Pink Snapper, *Pristipomoides filamentosus*), *‘ula’ulakoa’e/Onaga* (Ruby Snapper, *Etelis coruscans*), *‘ula’ula/Ehu* (Red Snapper, *Etelis Carbunculus*), *Hāpu’upu’u* (Sea Bass, *Epinephelus quernus*), and *Uku* (Gray Snapper, *Aprion virescens*).



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Bottomfish and Seamount Groundfish Fisheries

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2002 Annual Report

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Bottomfish and Seamount Groundfish Fisheries of the Western Pacific

2002 Annual Report

1.0 Introduction

The 2002 annual report provides a set of descriptors and indicators of the bottomfish fisheries from American Samoa, Guam, Hawaii and the Northern Mariana Islands. The descriptors are designed to document recent trends in landings, effort, participation, revenue and prices. Should management action be recommended, descriptor information will aid in assessing potential impacts of the action on fishery participants. The indicators are quantifiable and measurable tools used to identify signs of stress in the stocks or the fishery. Based on changes over time in indicator levels, the Bottomfish Plan Team (BPT) may identify "yellow light" situations (i.e., where stress is first detected) and recommend that either management action or additional study be undertaken or "red light" situations where immediate management action is needed.

The annual report is organized as follows: The introduction section defines and briefly explains the descriptors and indicators. The next section briefly summarizes time trends in descriptor and indicator levels, through the current year, and recommends any areas of concern for each island area. Reports from each island area are appended. The introduction describes the history and present characteristics of the fishery. Results of the current year's descriptors and indicators are presented in detail, in relation to past temporal trends. Figures are supported with information on source of the data, methods of calculation, and data interpretation. Table 1 summarizes 2002 bottomfish statistics for the region. The appended report from each area includes a summary of the new area specific and region-wide recommendations. Finally, additional appendices contain information on NMFS 2002 administrative and enforcement activities, habitat conditions, protected species interactions, and 2002 BPT membership.

Table 2 lists scientific, common English and local/indigenous names for bottomfish management unit species (BMUS) for each area (American Samoa, Guam/Northern Marianas, and Hawaii).

1.1 Definition of Descriptors

The fishery descriptors are defined as follows:

1.1.1 Landings information

Time series information on aggregate catch for each island area shows recent trends in total bottomfish harvest. For American Samoa and Guam, estimates of both the commercial landings and the total landings (combined commercial, recreational and subsistence) are available. For Hawaii and the Northern Marianas, landings information represents only the commercial harvest.

Table 1. Regional Summary of 2002 Bottomfish Species

	AS	GU	NMI	Hawaii			
				All	MHI	Mau	Hoomalu
BMUS Landings (lb)	40,769	88,740	47,110	589,774	361,774	108,000	120,000
Revenue (\$)	75,727	46,145	135,823	2,122,400	1,364,000	334,800	423,600
No. Of Boats	14	351	53	---	386	5	4
No. Of Trips	533	4,387	374	---	2556	76	26
CPUE	7.4 lb/trip-hr	3.0 lb/hr	126 lb/trip	---	179 lb/trip	1416 lb/trip	4638 lb/trip
SPR	---	---	---	0.26-0.47	note 1	note 2	note 2

Notes:

- 1) Species with Spawning Potential Ratio near or below threshold level of 0.20, indicating localized subarea depletion: MHI onaga ("targeted" SPR = 0.03); MHI ehu ("targeted" SPR = 0.11)
- 2) Healthy (SPR > 0.20) for all species

Table 2. Bottomfish Management Unit Species (BMUS) Names

(Absence of an indigenous name implies no local name established or area is not within the species' geographic range.)

Scientific	English Common	American Samoa	Guam/CN	Hawaii
<i>Bottomfish:</i>				
<i>Aphareus rutilans</i>	red snapper/silvermouth	palu-gutusiliva	maraap tatoong	lehi
<i>Aprion virescens</i>	gray snapper/jobfish	asoama	tosan	uku
<i>Caranx ignobilis</i>	giant trevally/jack	sapoanae	tarakito	white ulua/pau'u
<i>C. lugubris</i>	black trevally/jack	tafauli	trankiton attilong	black ulua
<i>Epinephelus fasciatus</i>	blacktip grouper	fauai	gadao matai	
<i>E. quernus</i>	sea bass			hapu'upuu
<i>Etelis carbunculus</i>	red snapper	palu-malau	guihan boninas	ehu
<i>E. coruscans</i>	red snapper	palu-loa	onaga	onaga
<i>Lethrinus amboinensis</i>	ambon emperor	filoa-gutumumu	mafuti/iililok	
<i>L. rubrioperculatus</i>	redgill emperor	filoa-pa'o'omumu	mafuti tatdong	
<i>Lutjanus kasmira</i>	blue line snapper	savane	sas/funai	ta'ape
<i>Pristipomoides auricilla</i>	yellowtail snapper	palu-i'usama	guihan boninas	yellowtail kalekale
<i>P. filamentosus</i>	pink snapper	palu-'ena'ena	guihan boninas	opakapaka
<i>P. flavipinnis</i>	yelloweye snapper	palu-sina	guihan boninas	yelloweye opakapaka
<i>P. seiboldi</i>	pink snapper		guihan boninas	kalekale
<i>P. zonatus</i>	snapper	palu-sega	guihan	
<i>Pseudocaranx dentex</i>	thicklip trevally		boninas/gindai	gindai
<i>Seriola dumerili</i>	amberjack		terakito	butaguchi/pig ulua
<i>Variola louti</i>	lunartail grouper	papa	guihan tatdong	kahala
			bueli	
<i>Seamount Groundfish:</i>				
<i>Beryx splendens</i>	alfonsin			kinmedai (Japanese)
<i>Hyperoglyphe japonica</i>	ratfish/butterfish			medai (Jap.)
<i>Pseudopentaceros richardsoni</i>	armorhead			kusakari tsubodai (Jap.)

In Hawaii, changes in species catch composition are provided for the Main Hawaiian Islands (MHI) and the Northwestern Hawaiian Islands (NWHI). Statistical tests for consistency in catch composition over time and between areas are included. Where possible, descriptor information has been presented for each NWHI management zone: Hoomalu and Mau. For 2002, pounds landed by species are presented in tabular form for each area except Hawaii. For Hawaii, NWHI BMUS landings by species are provided for 1986 through 2002.

1.1.2 Effort information

Effort is measured in number of trips for Hawaii and the Northern Marianas, and in both hours fished and trips taken for American Samoa and Guam.

1.1.3 Participation information

Estimates of the number of vessels making bottomfish landings are provided for all areas.

1.1.4 Economic information

Time trends in economic performance are characterized by plots of total ex-vessel revenue, aggregate average price levels, and for Hawaii, price trends over time for major species. In time-series of prices and revenues, it is appropriate to adjust value for the rate of inflation so that values throughout the time period are comparable (based on a consistent purchasing power for the dollar). Both the unadjusted and adjusted aggregate average price and aggregate revenues are plotted to clarify the relative change over time.

1.2 Definition of Indicators

Indicators were developed as tools for identifying signs of stress in the stocks or the fishery which deserve further investigation and/or a management response. Analyses consider how the indicators change over time. Indicators for Hawaii include 95% confidence intervals. To the degree possible, similar variance estimates are expected from the other areas in future annual reports. The indicators are defined as follows:

1.2.1 Aggregate Catch-Per-Unit-Effort

If the current year's aggregate catch-per-unit-effort (CPUE) is less than 50% of the average aggregate CPUE for the first three years of available data, there may be cause for concern. CPUE information is available for all areas; research CPUE is available for SE Hancock Seamount for all years since 1985, except in 1992 and 1994-2002.

1.2.2 Mean Fish Size

If there has been a significant reduction in mean fish size for a species over time, the stock may be stressed by the fishery. Mean size information is provided for nine species in Hawaii. No

mean size information was available at this time for American Samoa, Guam or the Northern Marianas.

1.2.3 Percent Immature

If over 50% of the catch for a species is below the size of first maturity, the stock may be stressed by the fishery. Information for this indicator by species is available only from Hawaii.

1.2.4 Spawning Potential Ratio

The spawning potential ratio (SPR) is the ratio of the spawning stock biomass per recruit, at the current level of fishing, to the spawning stock biomass per recruit that would occur in the absence of fishing. According to the overfishing definition contained in the Bottomfish FMP (Amendment 3, 1990), if SPR is less than or equal to 0.20, recruitment overfishing has occurred (i.e., spawners have been reduced to 20%, or less, of their unexploited stock level). Data to calculate SPR were not available from Guam or the Northern Marianas. An estimate of the "worst case" SPR was calculated for American Samoa's bottomfish complex using Dory Project data to estimate the virgin population CPUE and information on percent of immature fish from Hawaii. In Hawaii, SPR was calculated for five major species in the Hoomalu and Mau Zones, of the NWHI, and the MHI; some SPR values changed slightly from previous year's reports due to improvement in the calculations. SPR for armorhead was calculated annually since 1985, except for 1992 and 1994-2002.

1.2.5 Economic Indicators

Revenue per trip plots are presented for all areas except the MHI. A more valuable indicator for the commercial fisheries, which may be available in the future, would be net revenue (ex-vessel revenue minus costs per trip). Net revenue is available only from the Hoomalu Zone and Mau Zone in Hawaii.

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2.0 AREA SUMMARIES

2.1 American Samoa

2.1.1 Descriptors

During 2002, a total of 14 local boats landed an estimated 40,800 pounds of bottomfish, (about a 17% decrease from last years landings) Revenues for the domestic commercial fishery this year was estimated around \$75,727 (a 18.1% decrease from last year) with all the catch being sold locally. The CPUE for 2002 (7.4 lb/hr) was not less than 50% of the average aggregate CPUE for the first 3 years of available data.. In 2002, effort (trips and hours) increased.

2.1.2 Indicators

CPUE (pounds per hour), though relatively stable (at about 10 lb/hr) in the early 1990's, increased in 1996 to 14.8 lb/hr, mainly due to improved sampling. CPUE increased in 2001 to 15.2 lb/hr, the third highest CPUE since it was recorded in 1982, but decreased dramatically by about 51% in 2002 to 7.4 lb/hr, This level is not less than 50% of the average aggregate CPUE for the first three years of available data (9.7 lb/hr), indicating no cause for concern. Bottomfish revenue per trip (as opposed to total revenue) increased in 2002 (\$180/trip) by about 59% over 2001 (\$113/trip).

2.1.3 Recommendations

2002 Recommendations

A. DMWR biologists should further investigate the low CPUE recorded this year.

2.2 Guam

2.2.1 Descriptors

The fairly large fluctuations over time in bottomfish landings in Guam appear to be due more to entry and exit patterns of fishermen, rather than changes in fish stocks. The number of highliners fishing in the area doubled from 1993 to 1994, increasing the total commercial BMUS harvest and revenue by nearly 300% during that year. In 2002, a decrease in BMUS landings was due to decreases in landings of jacks, groupers, and snappers (26.1%, 9.5%, and 31.4% respectively). Emperor landings, however, increased by about 13%. Landings of all groups remained above the long-term. 2002 landings decreased by 33% from 2001, and is below the 15-year long term average.

The adjusted average price for bottomfish has not shown consistent marketing trends. This is believed to have resulted from the seasonal supply of pelagic fish and difficulties in developing a consistent market for locally caught fish. In addition, imported fish from other islands around the region have contributed to the continued marketing problem for local fishermen. The 2002 inflation-adjusted average bottomfish price of \$3.15 continues a decrease from last year and is down 12.5% from 1999 (\$3.60). The 2002 average price was 24.6% below the long term average.

2.2.2 Indicators

Total and BMUS bottomfish harvest decreased in 2002. Total bottomfish landings decreased 33%, with non-charter decreasing 39%. Charter catch increased 58%, but make up a small portion of the overall harvest. Total BMUS landings decreased 40%, with the non-charter and charter components decreasing 45% and 31% respectively. Offshore made 84% of both the total bottomfish catch and BMUS catch. The CPUE for all bottomfish decreased 21%, while the non-charter and charter CPUE decreased 20% and increased 19% respectively.

The commercial sale of BMUS species decreased 44% in 2001, with the adjusted revenue decreased 46%. The number of fishing vendors selling local fish decreased during 2002, and sales were affected by a lack of electricity and available ice after the supertyphoons. The number of boats bottomfishing, the number of bottomfish trips, and the number of hours spent fishing increased 4%, decreased 44%, and decreased 43% respectively.

2.2.3 Recommendations

2002 Recommendations

- A. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. DAWR's fisheries staff has discussed making progress towards completing this study when additional staff is available to ease the workload of the existing staff.
- B. DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes. Fine-tuning of this program should be completed in 2003
- C. The BPT recommends the Council send letters to the Governments of CNMI and Guam to provide legal authority to the local fishery departments to monitor and collect information from all fishing sectors.

- D. Regarding Guam offshore bottomfish management, the BPT supports alternative 2 but wants to ensure the following provisions are clarified:
- require permitted vessel to report on all fishing activity where ever fishing occurs.
 - consider at-sea transshipment of bottomfish, which has occurred in the past.
 - consider impacts to CNMI due to displaced larger vessels

2.3 Hawaii

2.3.1 Descriptors

Main Hawaiian Islands: Only commercial data are available for both the MHI and NWHI fisheries, even though the MHI recreational/subsistence catch is estimated to be about equal that of commercial landings. In 1988, there was a dramatic increase in MHI bottomfish landings due to a bonanza uku (gray snapper) harvest. A steady decline in total landings occurred until 1993, which was the lowest recorded annual value at the time. Landings increased 32% in 1994 and remained high through 1997, although CPUE was at a 12 year low in 1997. Participation and landings have declined over the past two years while CPUE has increased 29% in that same period. 2002 landings of 361,774 pounds are the lowest total landings since 1993 and the second lowest total landings since 1986. The 1.4% decrease in MHI bottomfish landings from 2001 to 2002 may be attributed to the 7.4% decline in number of trips taken in the MHI.

Total ex-vessel revenue from the MHI shows a general decline from 1988-1996 and has stabilized since. 2002 inflation adjusted revenue increased 6.6% from 2001 values, but still remains 41.4% below the long-term average.

NWHI Mau Zone: Mau Zone 2002 landings increased 116% from 2001 due to a 38.2% increase in number of trips from 55 in 2001 to 76 in 2002. Catch per trip increased by 54.6% in this zone. The total number of boats decreased from 6 in 2001 to 5 in 2002.

The Mau zone inflation adjusted revenue increased in 2002 to \$334,800, up 137.4% from \$141,000 in 2001. The inflation adjusted price per pound also increased in 2002 by 9.9%.

NWHI Hoomalu Zone: Hoomalu Zone 2002 landings decreased 49.2% from 2001. Four boats fished in 2002, one less than in 2002. The number of trips decreased by 36.6 % from 41 to 26. Bottomfish landings per trip decreased by 19.4% based on NMFS CPUE.

Inflation adjusted revenue decreased dramatically in 2002 (-43.6%), even though the inflated price per pound increased in 2002 by 11%.

2.3.2 Indicators

Hawaii Archipelago-wide:

SPR values for the five major BMUS species in 2002 are all above the 20% critical threshold level, that defines recruitment overfishing under the FMP, when viewed on an archipelago-wide basis. Of these species, onaga is still the lowest with a 2002 value of 26%. Implementation of the state's management plan should help improve the condition of onaga in the MHI and continue to increase the archipelago-wide SPR.

SPR values are also presented on a management zone basis (MHI, Mau Zone, Hoomalu Zone) for the purpose of determining locally depleted resources.

MHI: CPUE in 2002 decreased slightly from 2001 but remained above 1997 and 1998 levels. Recent CPUE values are approximately one-fourth the early (baseline 1948-50) values, signifying local depletion in the MHI. Most of the more commercially important species in the MHI have had relatively stable mean weights since 1984. Hapuupuu's mean weight dropped sharply in 1993 and has continued to be low. The small number of fish upon which the annual estimates are based may bias the result. However, with so many years in a row recording low mean weights, it is likely that marketed fish size has actually declined for MHI hapuupuu. Such a decline in mean size indicates increased stress on the MHI hapuupuu resource. These values do not exhibit a continuing decline, in fact, the 1997-2002 values are slightly greater than the 1995 lowest value.

For the eighth year 95% confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature). For the seventh year SPR values were calculated using both aggregate CPUE, as in previous years, and targeted CPUE, which gives a more accurate picture for individual species. 2002 aggregate CPUE SPR values for all five major species declined but remained above the 20% critical level, except for onaga and opakapaka: onaga (0.05), opakapaka (0.20), hapuupuu (0.26), ehu (0.24), and uku (0.24). The use of targeted CPUE showed a different picture for the four species where targeted trips are available. Here, ehu SPR is much worse than indicated using aggregate CPUE (SPR = 0.11), whereas SPR values for opakapaka and uku are much higher than previously indicated (SPR = 0.3029 and 0.2727, respectively). Onaga's SPR remains consistent when using targeted or aggregate CPUE and has now been below 0.20 for the past 10 years and ehu has increased to its highest SPR in 2001 since 1993 (using targeted CPUE).

NWHI Mau Zone: The NMFS CPUE data are only available for the NWHI fishery as a whole since 1984 and by zone since 1986. The NWHI (combined Mau and Hoomalu Zones) NMFS CPUE steadily decreased from 1987 to 1992, rose in 1993, and then declined from 1994-96. CPUE rose in 1997 to the 1993-94 level, but dropped slightly in 1998. CPUE decreased in 2001 to 467 lbs/day and continued to decreased in 2002 to 425 lb/day. The Mau Zone NMFS

CPUE had been steadily decreasing since 1989, but increased in 1993 and 1994. In 1997, NMFS CPUE rose 49%. The CPUE declined 15% in 1998 and 7% in 1999 to 337 lb/day. Mau Zone CPUE dropped to 260 lbs/day in 2000 to similar levels as in 1992 and 1993, but decreased by 9% in 2001. In 2002, CPUE increased to 438 lb/day, an increase of over 54.8% from 2001, and the highest CPUE since 1990. Mean weights of fish in the Mau Zone continue to exhibit year to year fluctuations, but are generally at much higher values than MHI mean weights. The percent of immature fish in the 2002 Mau Zone catch was just under 50% for all species evaluated.

SPR values in the Mau Zone have been decreasing since 1990 (mirroring the pattern in the HDAR CPUE), experienced a surprising rise in 1994, returned to lower levels in 1995, followed by a continued four year increase through 1999. All values are presently above well above the critical level of 0.20 for 2002. There was a notable increase in 2002 SPR values for all species evaluated in the Mau Zone, with all SPR values over 40%. SPR values are higher in the NWHI than the MHI because most of the catch is mature fish.

NWHI Hoomalu Zone: The Hoomalu Zone NMFS CPUE has been on a downward trend from since data collection began in 1988. 2002 CPUE continued to decrease to 412 lb/day from a 6-year high in 2000. Pounds per trip decreased by 19.4% in 2002. Mean weights of fish in the Hoomalu Zone continued to exhibit year to year fluctuations, but are still at much higher values than MHI mean weights. The percent of immature fish in the 2002 catch was just under 50% for all species evaluated.

The SPR values in the Hoomalu Zone decreased for all species. The 2002 SPR levels range from 41% to 65%.

Seamount Groundfish (Armorhead): No fishing has been allowed on the armorhead stocks of the SE Hancock Seamount since the moratorium began in August, 1986. The 1993 CPUE, calculated from research longline catches, was more than double that of the last assessment (in 1991) and nearly as high as the highest CPUE recorded since surveying began in 1985. No research cruise occurred since 1993, and future research assessment cruises are unlikely.

No SPR values were available in 2002 as no research was undertaken. In 1993, SPR within the EEZ (SE Hancock Seamount) was above 0.02, the highest since 1986, but still far below (10% of) the threshold level for recruitment overfishing of 0.20. About 99% of the known armorhead seamount habitat occurs outside the U.S. EEZ, an area which had 0.06 SPR in 1993. During February and March 1997, an oceanic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V Kaiyo Maru by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Armorhead larvae were collected from surface waters around all seamounts except for Koko Seamount.

2.3.3 Recommendations

2002 Recommendations

A. The BPT recommends the Council support and participate in the State of Hawaii's effort to review and assess effectiveness of the Main Hawaiian Island bottomfish area closures.

B. The BPT recommends that the NMFS re-evaluate MSY and standardized cpue and effort estimates for the Hawaiian archipelago.

2.4 Northern Mariana Islands

2.4.1 Descriptors

Data are available only on the commercial fishery. Landings of bottomfish has decreased (34.3% fewer pounds in 2002 than in 2001) from the highest total landings last year (57.1% more pounds in 2001 than in 2000), to slightly higher than the 20-year mean. This fishery continues to show a high turnover with changes in the high liners participating in the fishery, and an increased number of local fishermen focusing on reef fishes in preference to bottomfishes. In 2002, the number of vessels fishing decreased to 53 following 75 in 2001 and 66 in 2000. The number of trips decreased to just above the long term average with 374 trips, which is the down 55.2% from the highest number of trips recorded in 2001 (834).

Both the unadjusted and adjusted prices decreased in 2002. Both the unadjusted and adjusted prices decreased by 5.9% from 2001. The unadjusted price was higher than the long term average, but the adjusted price was 8.6% lower than the mean for the last 20 years. The total 2002 ex-vessel revenue decreased to \$135,823, the seventh-highest revenue in the last 20 years.

2.4.2 Indicators

The average bottomfish catch per trip increased from 86 lb/trip in 2001 to 126 lb/trip in 2002. Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g., changes in trip length and relative amounts of bottom fishing compared to trolling or reef fishing); it is the only measure readily obtained from the commercial landings system. However, the smaller vessels commonly make mixed trips and the relative proportions of bottom fishes to pelagic and reef fishes seem to be changing. Between 1997 and 2001 the number of fishermen selling both pelagic fishes and bottomfishes decreased and was lower than the 5-year mean. The number selling both pelagic and reef fishes increased in 2002 to greater than the 5-year mean. The number selling only pelagics also decreased to below the 5-year mean. Given that fishermen appear to be changing the focus of their trips to include more reef fishing and less bottom fishing, this measure is an increasingly inaccurate portrayal of the actual CPUE. It has been suggested that it may be possible to improve this measure of CPUE by using only those trips that landed bottomfish exclusively. However, in 2002, 0.0% of the fishermen making sales exclusively sold bottomfish. These numbers are too low to be indicative of the entire fishery.

Revenues significantly decreased (38% less than in 2001). The unadjusted revenue and inflation-adjusted revenue for 2002 is greater than the mean for the last 20 years, and is the seventh highest value. This is a result of the combined effect of lower pounds landed and a lower price per pound for almost all bottomfish species.

2.4.3 Recommendations

2002 Recommendations

- A. To request NMFS and the Council continue to assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.
- B. To request NMFS and the Council continue to assist the CNMI by supporting the MARAMP cruises to the northern islands of the CNMI.
- C. To request the council to hire a consultant to examine and assess the best way to capture the data necessary for fishery management (potentially through creel surveys, community development programs, commercial purchase systems, or other types of data collection systems), while including the local social, political, legal, and economic constraints within the CNMI.

2.5 Region-Wide Recommendations 2002

- A. The BPT recommends the Council send letters to the Governments of CNMI and Guam to provide legal authority to the local fishery departments to monitor and collect information from all fishing sectors.
- B. Regarding overfishing, the BPT recommends the Council conduct sensitivity analysis on the effects of MPAs on fishery based estimates of fishing mortality and cpue for potential impacts in relation to overfishing/overfished thresholds.

2.6 NMFS 2002 Administrative Activities

2.6.1 Use-it or Lose it Requirement for Permit Renewal (Calendar Yr 2002)

Mau Zone limited entry permits expire on December 31 each year. NMFS will renew a permit for the following year if the permit holder's vessel made a minimum of 5 separate landings, each of which consisted of at least 500 pounds of bottomfish management unit species, from the Mau Zone during the previous permit year. Failure to meet the required landing requirement may result in the permit being lost (not renewed). All 2002 Mau Zone limited entry permit holders will be required to meet this permit renewal requirement.

2.6.2 Northwestern Hawaiian Islands (NWHI) Bottomfish Fisheries

During calendar year 2002, PIAO issued a total of 9 permits for the NWHI bottomfish fishery. Five vessels fished in the Mau zone and four vessels fished in the Hoomalu zone. Four vessels were registered for the Ho'omalulu Zone fishery; 5 vessels were registered with Mau Zone permits.

Ho'omalulu Zone vessels

1. Ka Imi Kai
2. Fortuna
3. Laysan
4. Kealailani

Mau Zone vessels:

1. Kai Pali
2. Imua
3. Wahine Kapaloa
4. Jamie Elizabeth
5. Iwa Iani

2.7 NOAA Fisheries and USCG Enforcement Activities in 2002

2.7.1 NOAA Fisheries Office for Law Enforcement Southwest Enforcement Division

INVESTIGATIONS and ENFORCEMENT PARTNERSHIPS

Throughout this reporting period, random dockside compliance checks of Hawaii-based longliners were conducted. Minor technical violations were noted and addressed. In addition, several prominent investigations involving potential violations of the Western Pacific Pelagic Regulations addressing the harvesting of swordfish were initiated.

In order to facilitate a consolidated response to marine resource enforcement issues, the NOAA Office for Law Enforcement partnered with the Hawaii Department of Conservation and Resources Enforcement, the U.S. Coast Guard, the Guam Customs and Quarantine, Maritime Enforcement Unit, and the American Samoa Department of Marine and Wildlife Resources, Office of Enforcement.

Joint patrols were conducted with personnel from the Hawaii Department of Conservation and Resources Enforcement on the Big Islands of Hawaii in order to assess and deter potential harassment of spinner dolphins.

Enforcement personnel worked in partnership with researchers from the Pacific Islands Fisheries Science Center to resolve the status of land-locked sea turtles on private property. The turtles were listed as threatened or endangered. Strategies including returning the sea turtles to the open ocean.

The resident special agent in American Samoa attended the Coral Reef Advisory Group (CRAG) meeting and provided an enforcement assessment for the area.

The United States Navy in conjunction with the Pacific Missile Range Facility at Barking Sands, Kauai, relied on the NOAA OLE Hawaii Field Office to assist with the identification of fishing vessels in exclusion zone areas prior to missile test launches.

PUBLIC OUTREACH

Public education, outreach, and enforcement efforts in conjunction with the Hawaiian Islands Humpback Whale National Marine Sanctuary continued during 2002. Consistent with previous years, public education, deterrence, and intervention strategies were maintained throughout the 2001/2002 whale watching season. The NOAA Fisheries Office for Law Enforcement participated in pre-season enforcement workshops during November and December of 2001.

Enforcement personnel liaised with representatives from the native Hawaiian community as well as other local environmental advocates to address harassment issues impacting spinner dolphins on the Big Island of Hawaii. Informational community outreach letters were developed to educate ocean users, as well as local businesses about the requirements of the marine Mammal Protections Act relative as it applies to wild spinner dolphins in Hawaii.

VESSEL MONITORING SYSTEM

The Vessel Monitoring System (VMW) continued to be an integral part of the Pacific Islands/Southwest Law Enforcement's Monitoring, Control, and Surveillance (MCS) program. The VMS continued to be an effective tool for monitoring compliance with closed area and seasonal restrictions in the region, and cooperation from the fishing community continued to remain at high levels.

The size of the VMS program is relatively stable, with approximately 150 vessels in the program. OLE continued to monitor the entire permitted Hawaii longline fleet. In addition, most former Hawaii-based vessels that conducted fishing operations in California and American Samoa still have the VMS units on board.

Southwest Enforcement continued to monitor, as part of a voluntary demonstration, a US krill fishing vessel in the CCAMLR management area of Antarctica.

The VMS cued several investigations into alleged closed area violations. Additionally, the VMS continued to be an important tool to assist the United States Coast Guard in search and rescue operations.

The transition of the Main Hawaiian Islands longline closed area from the "Winter" to "Summer"

configuration happened on February 1st, and from "Summer" to "Winter" on October 1st. NMFS OLE did not observe any unauthorized activity related to these changes.

Throughout the year, Pacific Islands/Southwest OLE continued to coordinate efforts and assist NMFS Headquarters in the development of a national VMS Program.

To improve coral reef conservation in the Northwestern Hawaiian Islands, the VMS control center was modified to accept depth data that is transmitted automatically from VMS units. The project is ongoing, and the next phase will establish the transmission of depth data from vessel to shore side control center.

In retrospect, the Hawaii VMS Program has clearly demonstrated that a fishing vessel monitoring system can be an effective use of technology to improve monitoring, control and surveillance of regulated fisheries. VMS, in conjunction with air and surface patrols, promotes and supports regional strategies for conservation and management of highly migratory species in the Central and Western Pacific.

2.7.2 USCG Enforcement

United States Coast Guard Enforcement Activities

The United States Coast Guard (USCG) conducted roughly 800 hours of fisheries patrols with C-130 aircraft in the Central and Western Pacific ocean during fiscal year 2002. A balance in aerial surveillance effort was sought as well, yet during FY 2002, the majority of available C-130 resource hours were spent in support of the Homeland Security mission. The USCG deployed C-130s in response to intelligence cueing and increased fishing activity in close proximity to the non-contiguous EEZs. They conducted several C-130 deployments to American Samoa and Guam, with additional over-flights of Wake, Jarvis, Johnston, Howland-Baker, and Palmyra to monitor the Central and Western Pacific EEZs. Nevertheless, the need for flight hours to support the Maritime Homeland Security mission impacted their ability to deploy, and overall, there was a reduction in the total number of C-130 hours flown in support of fisheries enforcement.

The C-130 surveillance of the eight non-contiguous EEZs was broken down as follows: 520 hours in the Main Hawaiian Islands, 8 hours in the Northwest Hawaiian islands, 105 hours in Guam and the Northern Mariana Islands, 56 hours in American Samoa, 15 hours in Palmyra Atoll/Kingman Reef, 49 hours in Jarvis Island, and 41 hours in Howland/Baker Islands.

In FY 2002, over 1300 cutter hours of fisheries patrol were conducted in the Central and Western Pacific ocean. The USCG provided only a minimal presence in the Central and Western Pacific EEZs, as they continued to balance efforts between fisheries enforcement operations throughout the region and post- September 11th Homeland Security missions in the vicinity of the

Main Hawaiian Islands. There were almost 200 fishing vessel boardings in FY 2002. The breakdown of vessels boarded is as follows: 133 were U.S and 63 were foreign.

It is estimated that 89 EEZ encroachments by foreign fishing vessels occurred in FY 2002 and only three suspected violators were intercepted by Coast Guard units.

Appendix 1

American Samoa

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Summary

American Samoa's bottomfish fishery was relatively bigger between 1982 and 1986 than in recent years (Figure 1). This observation reflects a trend in the loss of skilled and full-time commercial fishermen from the fishery, the gradual depletion of newly discovered banks (e.g., 2% Bank), the shift of preference from bottomfishing to trolling and, recently, the diversion of effort by the highliner bottomfish fishermen towards longlining. The December 1992 hurricane contributed to the low 1992 landings (Figure 1) and the lowest number of trips recorded for the period 1982-1997 (Figure 3). A gradual increase in landings and revenues since 1998 converses the associated decrease in prices for the same period. A 290% increase in bottomfish imported from western Samoa contributed to the low market prices last year and again this year.

During 2002, a total of 14 local boats landed an estimated 40,800 pounds of bottomfish in the territory. Revenue for the domestic commercial fishery this year was estimated around \$75,700 with all catch being sold locally. The CPUE for 2002 (7.4 lb/hr) and not less than 50% of the average aggregate CPUE for the first 3 years of this fishery. Effort (hours and trips) has been increasing since 1998 as some of the alias that normally troll and/or longline perform bottomfishing when trolling and longline prices and catches decline. Overall average prices slightly dropped this year but prices for onaga and opakapaka increased mainly due to their demand by relatively new restaurants.

Regarding some of the SFA amendments: Commercial Bottomfish Landings and Revenues statistics for American Samoa is presented in Figure 2. No bottomfish Recreational trip was recorded this year. **Recreational** fishing is more associated with the pelagic fisheries and usually never occur in this fishery. There were no chartered bottomfish trip during this year and no **bottomfish by-catch was recorded this year (Table 3)**. In the *Preliminary Draft of EFH, Amendment for Bottomfish, WPRFMC Feb.1998*, the approximate MSY estimate for American Samoa [196 nautical miles 100-fathom isobath] is estimated at 79,000 lbs. per year. Only about 52% was reached this year.

Indicators derived from current data do not dictate a need for management response at this time.

The following selected annual statistics dating back to 1982 provide a brief historical snapshot of American Samoa's bottomfish fishery

Selected Historical Annual Statistics

Year	Total Landings (lb)	CPUE (lb/trip-hr)	Adjusted Revenue	Adjusted Price/Lb.	CPI	Number of Boats
1982	64942	8.5	\$192229	\$3.09	100.0	27
1983	126327	10.0	\$451790	\$3.61	100.8	38
1984	94104	10.7	\$274745	\$2.96	102.7	48
1985	143225	8.1	\$230778	\$2.25	103.7	47
1986	91533	8.3	\$185265	\$2.04	107.1	34
1987	31232	11.9	\$68870	\$2.24	111.8	20
1988	63251	17.3	\$142944	\$2.36	115.3	27
1989	47482	16.7	\$78495	\$2.17	120.3	29
1990	14303	9.2	\$27102	\$2.17	129.6	19
1991	18677	9.1	\$37184	\$2.10	135.3	20
1992	13316	9.3	\$33333	\$2.51	140.9	14
1993	17518	7.3	\$36548	\$2.35	141.1	22
1994	44982	7.7	\$91171	\$2.20	143.8	19
1995	34414	9.8	\$66929	\$1.97	147.0	25
1996	38519	14.8	\$76737	\$2.03	152.5	26
1997	39867	14.7	\$89430	\$2.34	156.4	24
1998	15862	14.0	\$38124	\$2.65	158.4	16
1999	19563	12.9	\$45459	\$2.63	159.9	22
2000	28215	10.2	\$55700	\$2.13	166.7	17
2001	48944	15.2	\$92459	\$2.38	168.8	18
2002	40769	7.4	\$75727	\$2.13	169.2	14
Averages	49383	11.1	\$113858	\$2.40		25.0
Std. Dev.	35689	3.1	\$101273	\$0.40		9.42

Introduction

Bottomfishing utilizing traditional canoes by the indigenous residents of American Samoa has been a subsistence practice since the Samoans settled into the Tutuila, Man'ua and Aunu'u islands. It was not until the early 1970's that the bottomfish fishery developed into a commercial scheme utilizing motorized boats. A government subsidized program, called the Dory Project, was initiated in 1972 to develop the offshore fisheries into a commercial venture, and resulted in an abrupt increase in the fishing fleet and total landings. In 1982, a fisheries development project aimed at exporting high-priced deep-water snappers to Hawaii caused another notable increase in bottomfish landings and revenues. Between 1982 and 1988, the bottomfish fishery comprised as much as 50% (by weight) of the total commercial landings. Beginning in 1988, the nature of American Samoa's fisheries changed dramatically with a shift in importance from bottomfish fishing towards trolling. In the past eight years, the dominant (by weight of fish landed) fishing method has been longlining.

During the early 1980's, fisheries data were collected from the bottomfish fishery by interviewing only commercial vessels. In the current Offshore Creel Survey on Tutuila that started on October 1, 1985, commercial, subsistence and recreational domestic fishing boats landing catch in five designated areas were interviewed and their catch recorded. For two weekdays and one weekend/holiday per week, DMWR technicians normally sampled offshore trips between 0500 and 2100 hours. In the past three years, the sampling period was increased to cover boats that come in earlier or after the normal sampling period. Two DMWR samplers based on Tau and Ofu collect fisheries data from the Manu'a islands fleet.

Boat-based fishing in American Samoa used to be mainly trolling and/or bottomfish. In the past six years, longline landings significantly increased with revenues reaching around one million dollars in the past two years. Bigger foreign boats are entering the local fisheries but these are rigged for longlining and more of these are expected to enter the territory's longline fishery. Limited entry options have been initiated to check this increase.

The bottomfish fishery of American Samoa was typically commercial overnight bottomfish handlining using skipjack tuna as bait, on 28-30 foot aluminum/plywood alias. Lower quality bottomfish imported from western Samoa helps satisfy the demand for bottomfish but at the same time result in unattractive prices for local bottomfish fishermen. The adverse effects of three hurricanes that struck American Samoa in 1987, 1990 and 1991 can be seen in some of the trends in the fishery as depicted by the data in this report.

Recent changes in the fishery and improvements in the Offshore Creel Survey necessitates continuous modifications to algorithms used to process the data for this report. Hence the continuous need for technical support from WPacFIN.

Recommendations

2001 Recommendation:

DMWR should start preparing a sampling program for the alias fishing out of Vatia and Aunuu (not included in the normal sampling area) to improve coverage of the fisheries.

Status of 2001 Recommendations:

WPacFIN-DMWR has implemented an offshore creel survey on Aunuu and are still planning to expand sampling to cover the Vatia village fleet.

2002 Recommendation:

DMWR biologists should further investigate the low CPUE recorded this year.

Table 1. American Samoa 2002 Estimated Total Bottomfish Landings by Species.

Interpretation: Changes in species composition of the bottomfish complex reported in the past are due to samplers' varying ability and commitment to the identification of the various bottomfish species. Historical and current data and observations however, do not indicate any major changes in the composition of the bottomfish species landed.

Source: DMWR Offshore Creel

Calculation: Catches are normally weighed by species either at landing sites or during the selling of fish to stores and restaurants. Trips missed by the Creel Survey are accounted for in a separate data collection system – the Commercial Invoice System. This analysis, as in the past, is for the Offshore Creel Survey catch only. Analysis of the bottomfish fishery presented in this report is for the whole bottomfish complex and **not just for the BMUS.**

Species	Pounds
Blood snapper	4
Blue lined gindai	34
Blue lined snapper	7159
Ehu (squirrelfish snap.)	1507
Gindai (flower snap)	123
Gray jobfish	2920
Hawaiian opakapaka	66
Humpback snapper	2320
Lehi (silverjaw)	4654
Onaga (longtail snapper)	1380
Onespot snapper	48
Rufous snapper	50
Stone's snapper	68
Twinspot/red snapper	419
Yellow opakapaka	1515
Yelloweye opakapaka(P.fl.	6
Yellowtail snapper	9
Groupers (misc)	1288
Blacktip grouper	98
Flagtail grouper	52
Lunartail grouper	1561
Peacock grouper	33
Striped grouper	8
Tomato grouper	296
Emperors (misc)	12105
Longnose emperor	578
Redgill emperor	120
Jacks (misc)	240
Bigeye trevally	980
Black jack	581
Whitemouth trevally	24
Bottomfish (Assorted)	523
Total Bottomfish	40769

Table 2. American Samoa 2002 Estimated Commercial Landings by Species.

Interpretation: There appears to be no major changes in the prices of individual species in the past eight years. DMWR keeps track of fish prices for imported fish and those missed by the Offshore Creel Survey through a separate data collection system – the Commercial Invoice System. Data from that data processing system reveal that since 1992, the average price of bottomfish imported from western Samoa were lower than locally caught bottomfish. Locally caught bottomfish are of much superior quality than those imported from western Samoa (and previously from Tonga) because of better handling and affordable ice. Local fishermen, therefore, expect comparatively higher prices for their local bottomfish. Prices for some important species like opakapaka and onaga increased again this year.

Source: DMWR Offshore Creel Survey and Commercial Invoice System

Species	Pounds	Price/Lb.	Value
Blood snapper	4	\$1.61	\$6
Blue lined gindai	34	\$2.00	\$68
Blue lined snapper	6312	\$1.97	\$12439
Ehu (squirrelfish snap.)	1482	\$2.60	\$3861
Gindai (flower snap)	109	\$2.75	\$300
Gray jobfish	2609	\$1.57	\$4094
Hawaiian opakapaka	56	\$2.75	\$154
Humpback snapper	1881	\$1.99	\$3749
Lehi (silverjaw)	4528	\$2.38	\$10788
Onaga (longtail snapper)	1350	\$2.59	\$3490
Onespot snapper	46	\$1.37	\$63
Rufous snapper	29	\$2.75	\$80
Stone's snapper	59	\$2.75	\$162
Twinspot/red snapper	169	\$1.75	\$295
Yellow opakapaka	1504	\$3.69	\$5544
Yelloweye opakapaka(P.fl.	6	\$2.75	\$17
Yellowtail snapper	9	\$2.50	\$23
Groupers (misc)	1185	\$1.96	\$2327
Blacktip grouper	94	\$2.75	\$259
Flagtail grouper	42	\$2.75	\$116
Lunartail grouper	676	\$1.93	\$1307
Peacock grouper	33	\$2.00	\$65
Striped grouper	8	\$2.75	\$22
Tomato grouper	175	\$2.46	\$430
Emperors (misc)	10757	\$1.97	\$21173
Longnose emperor	429	\$2.00	\$858
Redgill emperor	120	\$2.00	\$240
Jacks (misc)	230	\$0.75	\$173
Bigeye trevally	660	\$2.21	\$1458
Black jack	457	\$2.42	\$1106
Whitemouth trevally	24	\$1.90	\$46
Bottomfish (Assorted)	523	\$1.95	\$1017
Total Bottomfish	35599	\$2.13	\$75727

Calculation: During creel surveys, the disposition of the catch is recorded, and if sold, the price is obtained whenever possible. The average prices reported in this table are calculated by dividing the total revenue by the weight sold in pounds for each species.

Table 3. American Samoa 2002 Bottomfish Bycatch

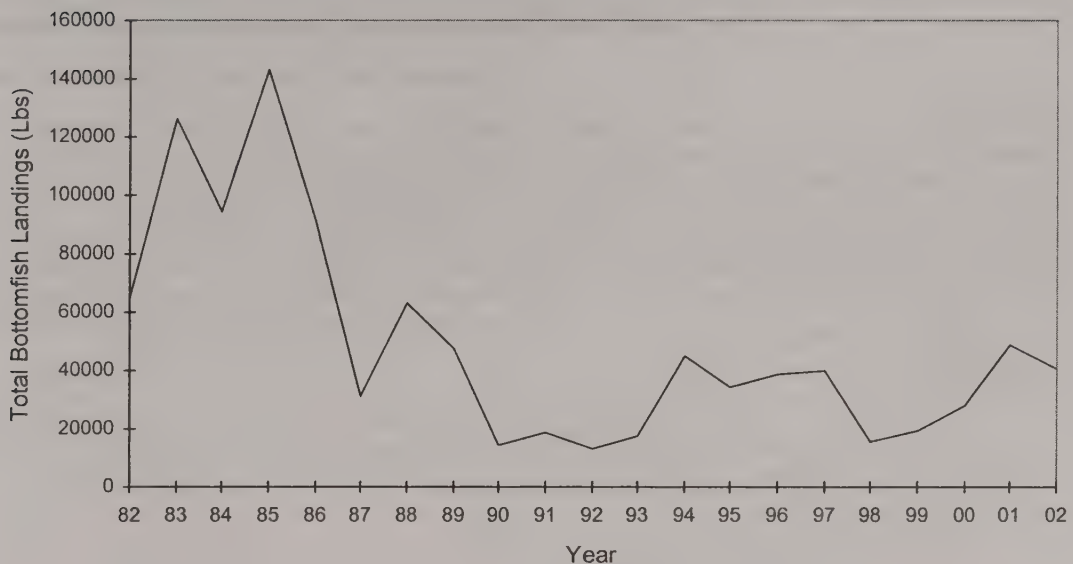
Species	Bycatch				Catch	%BC	Interviews		
	Alive	Dead Inj	Unk	Total			With BC	All	%BC
No Bycatch							0	470	0.00
All Species (Comparison)					6959	0.00			

Interpretation: No bycatch was recorded this year.

Source: DMWR Offshore Creel Survey

Calculation: The Bottomfish Bycatch table is obtained from creel survey interviews. The Bycatch numbers are obtained by counting fish in the interviews for purely bottomfishing trips with a disposition of bycatch. The catch for all species included for comparison is obtained by counting all species of fish caught by purely bottomfishing interviews and the number of interviews is a count of purely bottomfishing interviews

Figure 1. American Samoa Total Bottomfish Landings



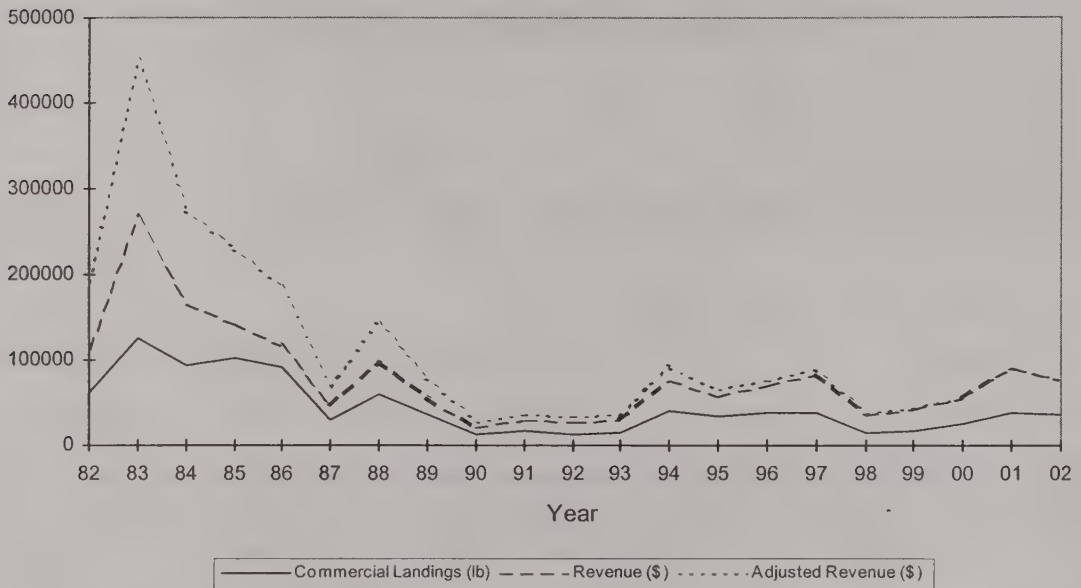
Interpretation: The substantial decline in landings in 1987 and 1990 were partially due to vessel losses caused by two hurricanes. Boat repairs were delayed as fisherman repaired or rebuilt their houses. In terms of total landings, the bottomfish fishery is much smaller in recent years than it was any time between 1982 and 1986, a period when there was a relatively large fleet and fishermen were attracted to the profitable bottomfish export program that exported deep-water snappers to Hawaii. The increase in 1994 was due primarily to improved sampling on Tutuila and increased efforts by the Tutuila highliners. Furthermore, the Manua landings more than tripled due to social/cultural events during the year. The 1998 decline mirrored the 33% decrease in the number of boats participating. Since 1998 some alias have been bottomfishing when longline catches and prices declined. A few veteran successful bottomfish fishermen left the fishery and may have contributed to the recent decline.

Source: DMWR Offshore Creel Survey Database

Calculation: Bottomfish landings for 1982-84 were calculated by adjusting the sampled Tutuila data by the calculated annual percent coverage of the fleet, and then adding the similarly adjusted Manua landings. The landings from 1986 to Present were calculated by expanding the Offshore Creel Survey Data for Tutuila for the species listed in Table 1. The sampled Manua landings were adjusted by adjusting for the monthly percent coverage of the fleet and added to the Tutuila data. Since the Offshore Creel Survey started in October 1, 1985, The first nine month of the 1985 landings were calculated as they were in 1982-84 and the last three months of the 1985 landings were calculated as post 1986 data.

Year	Landings(lb)
1982	64942
1983	126327
1984	94104
1985	143225
1986	91533
1987	31232
1988	63251
1989	47482
1990	14303
1991	18677
1992	13316
1993	17518
1994	44982
1995	34414
1996	38519
1997	39867
1998	15862
1999	19563
2000	28215
2001	48944
2002	40769
Average	49383
Std. Dev.	35689

Figure 2. American Samoa Estimated Commercial Bottomfish Landings



Interpretation: Commercial landings mirror the total fishery's low catches in recent years compared to the robust 1982-1986 period. Relative to total landings, commercial landings decreased even more substantially in 1989, because the percent of the catch sold by bottomfish fishermen dropped from an average of about 97% in 1982-88 to 78% in 1989. The peak in 1983 portrays the high prices of deep-water snappers exported to Hawaii, while the trough in 1987 can be attributed to effects of the 1987 hurricane. The December 1991 hurricane contributed largely to the decreased landings and subsequently a decrease in revenues in 1992. Unfavorable weather continued through May 1992 hindering commercial bottomfish trips. Increased efforts in 1994 produced a

Year	Commercial Landings (lb)	Revenues	Adj. Factor	Adjusted Revenue
1982	62016	\$113678	1.691	\$192229
1983	125167	\$269083	1.679	\$451790
1984	92841	\$166917	1.646	\$274745
1985	102670	\$141495	1.631	\$230778
1986	90775	\$117331	1.579	\$185265
1987	30740	\$45519	1.513	\$68870
1988	60503	\$97440	1.467	\$142944
1989	36165	\$55789	1.407	\$78495
1990	12535	\$20752	1.306	\$27102
1991	17748	\$29747	1.250	\$37184
1992	13264	\$27777	1.200	\$33333
1993	15591	\$30482	1.199	\$36548
1994	41429	\$77527	1.176	\$91171
1995	33956	\$58148	1.151	\$66929
1996	37908	\$69195	1.109	\$76737
1997	38342	\$82653	1.082	\$89430
1998	14400	\$35697	1.068	\$38124
1999	17247	\$42967	1.058	\$45459
2000	26164	\$54877	1.015	\$55700
2001	38767	\$92274	1.002	\$92459
2002	35599	\$75727	1.000	\$75727
Average	44944	\$81194		\$113858
Std. Dev.	31649	\$56746		\$101273

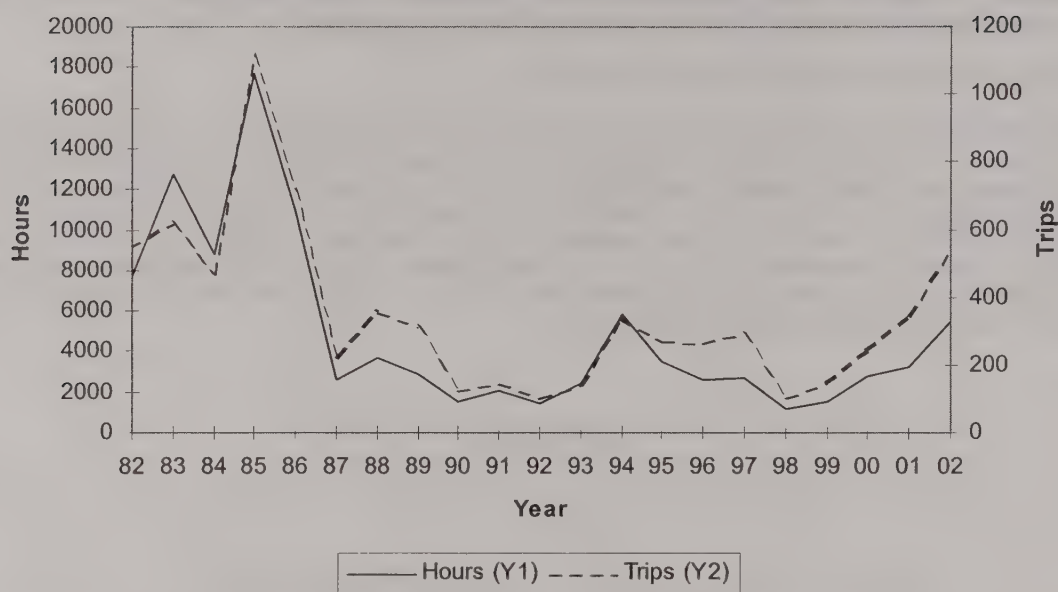
a notable increase in revenues and no major changes in commercial landings have been recorded since

then. Increase volumes of bottomfish “not sold” contributed to the decrease in commercial landings and revenue. For the last quarter, significant increases in sampled bottomfish trips were recorded as local fishermen fish more on Saturdays for the traditional Sunday meals (toana’i)

Source: DMWR Offshore Creel Survey Database

Calculation: A relatively complex set of algorithms are used to estimate the commercial landings from estimates of total landings created by the creel survey data expansion system. In short the percent sold by species and by fishing method is calculated annually and multiplied by the estimated total landings by that method for that year. For 1982-85 sampling was conducted on the commercial fleet only (which included nearly all of the fishing boats), whereas since the 1985 creel sampling has covered all boats (commercial and recreational). Analysis of creel data for 1986-87 indicates that over 98% of the landed bottomfish were being sold. Therefore it is believed to be valid to compare commercial data for years prior to 1986 to creel survey totals for years since 1986.

Figure 3. American Samoa Estimated Bottomfish Hours and Trips



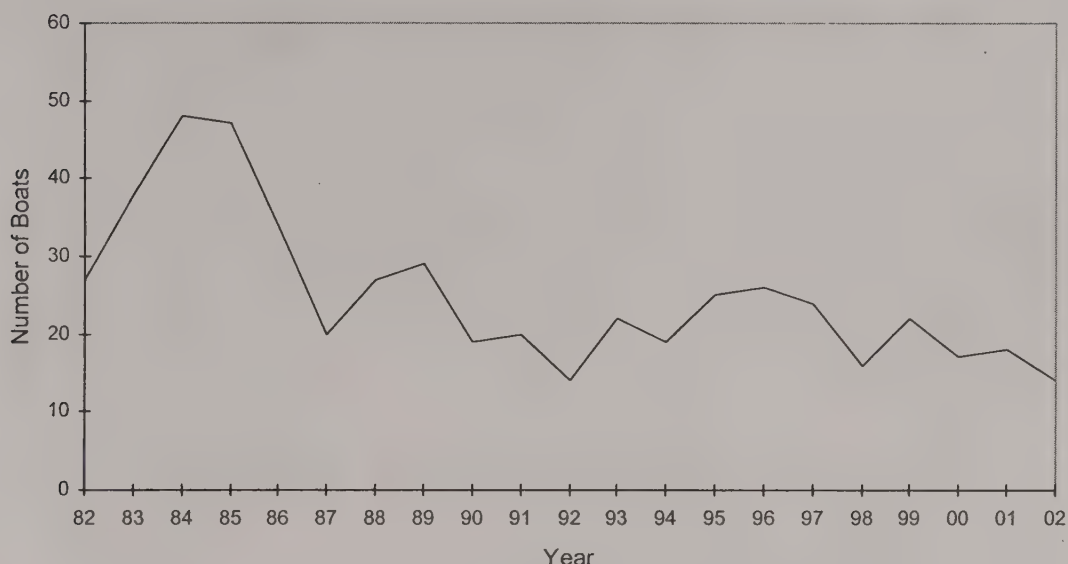
Interpretation: The sharp decline in the bottomfish landings since 1986, noted in Fig.1 is mirrored in this figure by a sharp decline in the level of effort expended in that fishery. Rather than indicating a problem with the resource, this decline depicts an actual trend of commercial boat owners and fishermen seeking other more lucrative and stable lines of work. The 1994-1996 estimated efforts were greater than those for the 1990-93 period due to the highliners increased efforts, with some boat owners employing teams (usually 2-3 fishermen) in continuous shifts during good weather. In 1997 and 1998 the number of boats participating in this fishery dropped significantly (see Figure 4) resulting in the notable declines in the number of trips and hours fished that period. The 1999 increase in effort can be attributed to some alias that normally longline and troll, doing occasional bottomfishing and those that normally bottomfish made additional trips.

Source: DMWR Offshore Creel Survey Database

Calculation: The annual estimated hours spent bottomfishing is calculated by dividing the annual total bottomfish catch by the average CPUE (pounds per hour) from trips doing only bottomfish fishing. The annual estimated number of trips is calculated by dividing the estimated annual hours by the average length of a bottomfish fishing trip. The average length of a bottomfish fishing trip (not shown) is calculated by using only trips which exclusively bottomfished and for which the trip length was recorded. The total hours fished from those trips is then divided by the number of trips. Recorded hours are trip hours.

Year	Hours	Trips
1982	7671	548
1983	12695	621
1984	8796	468
1985	17682	1116
1986	10983	717
1987	2632	220
1988	3661	354
1989	2844	313
1990	1548	122
1991	2042	145
1992	1426	101
1993	2393	141
1994	5857	341
1995	3497	270
1996	2608	265
1997	2712	290
1998	1132	100
1999	1519	145
2000	2769	244
2001	3210	342
2002	5480	533
Average	4912	352
Std. Dev.	4248	242

Figure 4. American Samoa Annual Estimated Number of Boats Landing Bottomfish



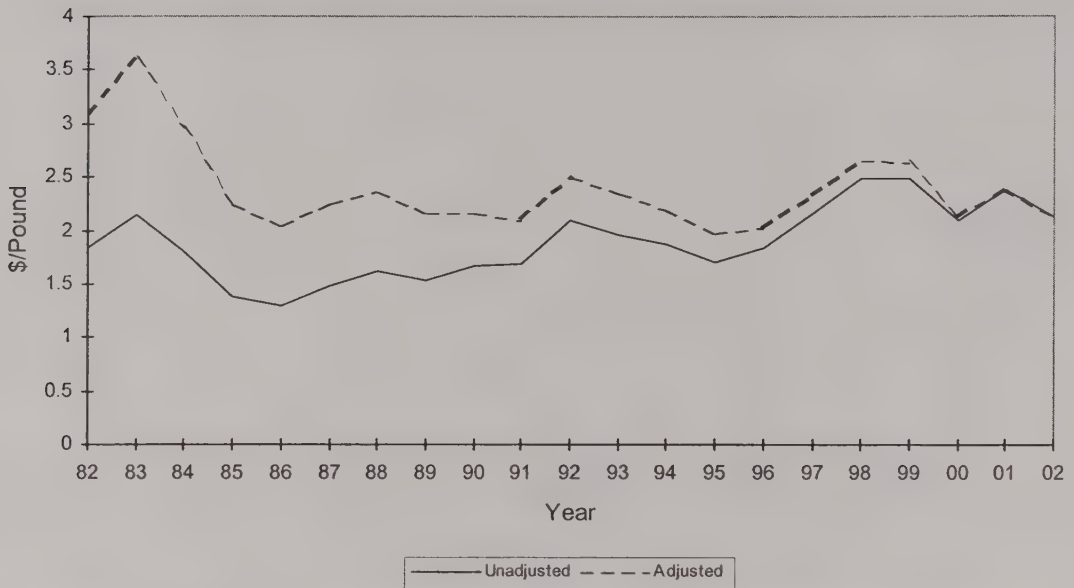
Interpretation: The decline in the fishery since 1985-86 is reflected by a decline in the number of boats participating in it. The 1987 hurricane caused the loss of the whole Manu'a fleet, plus some of the Tutuila fleet. Several boats that contributed to the 1989 bottomfish annual landings did not land any bottomfish in 1990, due to much needed boat repairs and their participation in non-bottomfish chartered trips. About 90% of the domestic fishing fleet was affected by the December 1991 hurricane, hence the slight decline in 1992. The increase in 1993 is due mainly to the re-entry to this fishery of a few boats after repairs, trips by two 14-foot vessels that didn't bottomfish in 1992, and the entry of one new Alia into the sampling area. A few new alia were bought from western Samoa and entered the fishery in 1995-1996. The continued increase in the number of bottomfish alia electing to longline, attracted by the relatively higher revenues obtained mainly from albacore sold to the canneries, is reflected in the significant drop in the number of boats bottomfishing in 1998. Four alia left the fishery this year.

Source: DMWR Offshore Creel Survey database

Calculation: The annual estimate of the number of boats in the bottomfish fishery is obtained from the data base by counting the unique boats sampled during the year which landed any bottomfish species regardless of fishing method.

Year	Boats
1982	27
1983	38
1984	48
1985	47
1986	34
1987	20
1988	27
1989	29
1990	19
1991	20
1992	14
1993	22
1994	19
1995	25
1996	26
1997	24
1998	16
1999	22
2000	17
2001	18
2002	14
Average	25
Std. Dev.	9

Figure 5. American Samoa Average Price of Bottomfish



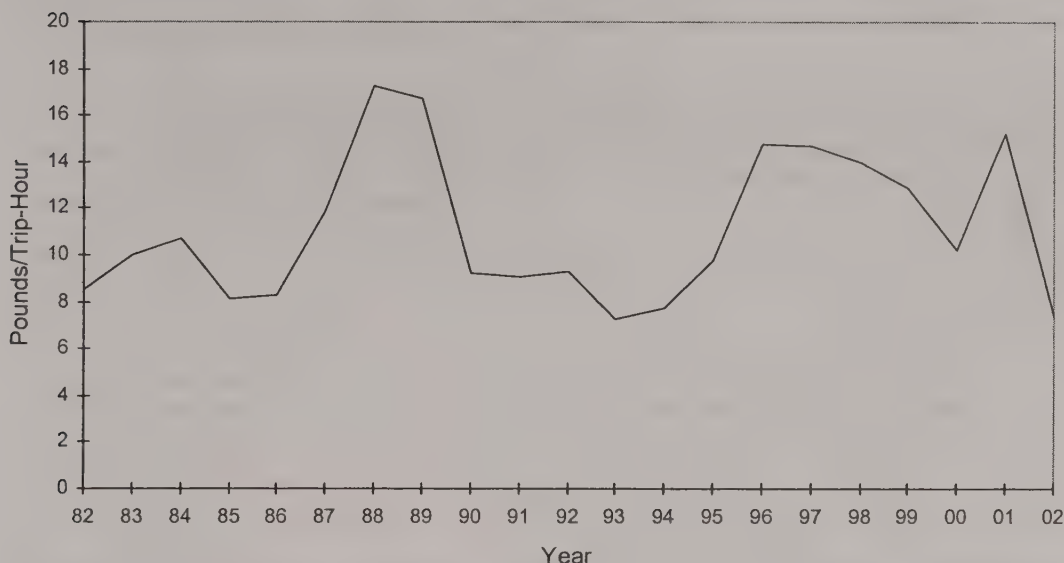
Interpretation: Prices were generally higher between 1982 and 1984 during the exportation of high-priced deepwater snappers to Hawaii. After this period, inflation-adjusted local prices have generally been stable. Prices of locally caught bottomfish are generally higher than imported fish, and could have been even higher had the local markets not been flooded by imported fish, which are usually of lower quality. The only imported bottomfish in 1994 were from western Samoa and these were sold at an average price of \$1.67/lb. Imported bottomfish (mainly from western Samoa) have always helped in meeting the demand for bottomfish. The increase in average price in 1998 is attributed mainly to the increase in demand for fresh bottomfish by a few new restaurants. Variable volumes of low-priced bottomfish from neighboring western Samoa contributes to the fluctuating local prices.

Source: DMWR Offshore Creel Survey database

Calculation: The average price of all bottomfish species combined is calculated by dividing total bottomfish revenue by total sold weight. The inflation-adjusted price is calculated by multiplying the unadjusted annual average price by the annual calculated consumer price index (CPI) for American Samoa using the current year as base.

Year	Unadjusted Price/Lb	Adjusted Price/Lb
1982	\$1.83	\$3.09
1983	\$2.15	\$3.61
1984	\$1.80	\$2.96
1985	\$1.38	\$2.25
1986	\$1.29	\$2.04
1987	\$1.48	\$2.24
1988	\$1.61	\$2.36
1989	\$1.54	\$2.17
1990	\$1.66	\$2.17
1991	\$1.68	\$2.10
1992	\$2.09	\$2.51
1993	\$1.96	\$2.35
1994	\$1.87	\$2.20
1995	\$1.71	\$1.97
1996	\$1.83	\$2.03
1997	\$2.16	\$2.34
1998	\$2.48	\$2.65
1999	\$2.49	\$2.63
2000	\$2.10	\$2.13
2001	\$2.38	\$2.38
2002	\$2.13	\$2.13
Average	\$1.89	\$2.40
Std. Dev.	\$0.34	\$0.40

Figure 6. American Samoa Annual Bottomfish CPUE



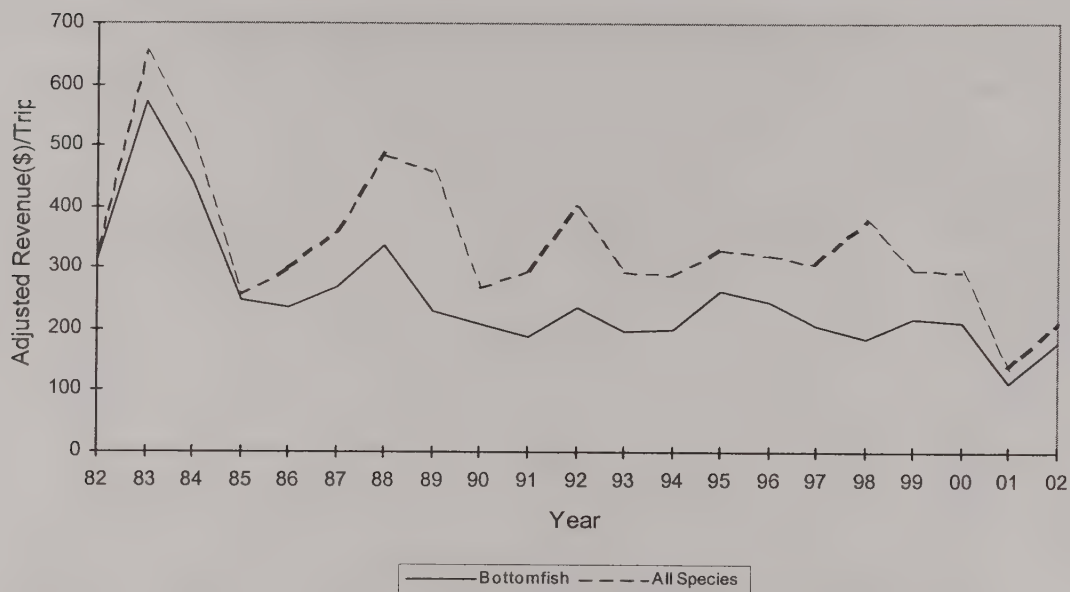
Interpretation: The initial increased CPUE in 1983 and 1984 occurred during the intense fishing of some new fishing grounds for deepwater snappers for export to Hawaii. A relatively high number of boats and local fishermen participated in the fishery during this period. The decline in 1985 and 1986 might be expected following the ardent harvesting of the limited fishing grounds. Reasons for the CPUE peak in 1988-89 are unknown. The decline in CPUE from 1989 to 1991 can be partially attributed to a combination of some new inexperienced fishermen entering the fishery and the exit of experienced and full-time commercial fishermen. CPUE has essentially remained stable during 1990-1992, increased for a few years and was relatively stable in 1996-1998. Bottomfishing techniques and gear have generally remained the same in the past years with the alias being the highliners since the early 1970's. The 1996 high CPUE estimates (and most probably the 1988-89 CPUE increase) can be attributed mainly to improved sampling and may also be related to favorable environmental conditions. This also may represent cyclical trends that maybe caused by decadal and inter-annual climatic changes with similar trends shown in the Hawaii bottomfish fishery. This year's low CPUE was not less than 50% of the average aggregate CPUE for the first three years of available data. The low CPUE this year may be partially attributed to three very experienced bottomfish fishermen leaving the fishery.

Source: DMWR Offshore Creel Survey database

Calculation: CPUE is calculated using only trips in which only the bottomfish method was used and trip hours were recorded. The average is calculated by using each CPUE from each trip as an observation and dividing by the number of trips.

Year	CPUE
1982	8.50
1983	10.00
1984	10.70
1985	8.10
1986	8.30
1987	11.90
1988	17.30
1989	16.70
1990	9.20
1991	9.10
1992	9.30
1993	7.30
1994	7.70
1995	9.80
1996	14.80
1997	14.70
1998	14.00
1999	12.90
2000	10.20
2001	15.20
2002	7.40
Average	11.10
Std. Dev.	3.11

Figure 7. American Samoa Average Inflation-Adjusted Revenue Per Trip Landing Bottomfish.



Interpretation: There have been no notable changes in revenues per trip since 1990. The distance between these two lines reflects the relative importance of bottomfish species in the total catch whenever any bottomfish are landed. The prominent importance of bottomfish between 1982 and 1985 occurred during the targeting of deepwater snappers (mainly *Etelis* and *Prisitipomoides*) for export to Hawaii. Bottomfish fishing was also the more profitable method of fishing during that period. The relative importance of bottomfish has generally been declining since 1985 as most of the full-time commercial fishermen quit this fishery with the remaining opting for trolling and lately, longlining. The supply of locally caught

Year	Bottomfish Unadjusted	Bottomfish Adjusted	All Species Unadjusted	All Species Adjusted
1982	\$185	\$312	\$196	\$331
1983	\$341	\$573	\$388	\$652
1984	\$269	\$442	\$309	\$509
1985	\$151	\$246	\$157	\$256
1986	\$150	\$236	\$189	\$299
1987	\$178	\$269	\$239	\$361
1988	\$231	\$338	\$332	\$487
1989	\$163	\$230	\$327	\$459
1990	\$160	\$209	\$205	\$268
1991	\$151	\$189	\$237	\$296
1992	\$196	\$236	\$332	\$398
1993	\$165	\$197	\$246	\$295
1994	\$171	\$201	\$245	\$288
1995	\$227	\$261	\$288	\$331
1996	\$221	\$245	\$290	\$322
1997	\$190	\$206	\$283	\$306
1998	\$172	\$184	\$355	\$379
1999	\$204	\$216	\$281	\$298
2000	\$208	\$211	\$290	\$295
2001	\$113	\$113	\$138	\$138
2002	\$180	\$180	\$211	\$211
Average	\$192	\$252	\$264	\$342
Std. Dev.	\$47	\$97	\$64	\$109

bottomfish has been supplemented by bottomfish imported from western Samoa. Even though commercial landings (and average price/lb) decreased, prices for high-priced deep-water snappers (e.g. onaga and opakapaka) continued to increase within the past two years, and may contribute to the increase in revenues per trip.

Source: DMWR Offshore Creel Survey database

Calculation: The average revenue per trip for all species is calculated by summing the revenues of all sales for any trip which landed any bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trip is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips. Figure 7 plots the inflation-adjusted bottomfish and all species revenue per trip for the period 1982-2002.

Appendix 2

Guam

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Introduction

There are two distinct bottomfish fisheries on Guam that can be separated by depth and species composition. The shallow water complex (<500 feet) makes up a larger portion of the total bottomfish effort and usually the harvest, comprised primarily of reef-dwelling snappers, groupers, and jacks of the genera *Lutjanus*, *Lethrinus*, *Aprion*, *Epinephelus*, *Variola*, *Cephalopholis* and *Caranx*. The deepwater complex (>500 feet) consists primarily of groupers and snappers of the genera *Pristipomoides*, *Etelis*, *Aphareus*, *Epinephelus*, and *Cephalopholis*.

Bottomfishing on Guam is a combination of recreational, subsistence, and small-scale commercial fishing. Bottomfish activity can be highly seasonal during the summer when sea conditions are generally calmer, although calm sea conditions can occur every month of the year, which results in an increase in bottomfish activity. Fishing activity increases dramatically on the east side of the island, a more productive fishing area, during periods of calm weather. The majority of people in this fishery are either subsistence or part-time commercial, operate boats less than 25 feet in length, target primarily the shallow water bottomfish complex, and combine some trolling to supplement their overall fish catch. In recent years, the consumption of reef fish has increased on Guam, making it profitable to sell locally caught bottomfish. This demand, however, appears to be stressing bottomfish stocks around Guam. Bottomfish and BMUS species are not caught by only by bottomfishing, but also by other methods such as gillnetting and spearfishing.

The Agana Boat Basin, centrally located on the western leeward coast, is the island's primary launch site for boats fishing areas off the central and northern leeward coasts and the northern banks. Most commercial fishing boats operate from here. The Merizo boat ramp, Seaplane Ramp in Apra Harbor, Umatac boat ramp, and Agat Marina are launch sites which provide access to the southern coast, Apra Harbor, Cocos Lagoon, and the southern banks. The Agat Marina, located between the Agana Boat Basin and the Merizo boat ramp, provides trailered boats from the northern and central areas of the island a closer and more convenient launch site to the southern fishing grounds. A makeshift ramp at Ylig Bay provides access to fishing areas on the eastern side of the island, and is heavily used during periods of calm weather. Surveying the Ylig ramp during the summer has been proposed since significant quantities of BMUS species are landed there by bottomfishing or spearfishing. However, a lack of adequate lighting, no public phone for emergencies, and other safety issues make surveying this area challenging. At present, Department of Agriculture's Fisheries Section conducts its offshore creel surveys at the Agana Boat Basin, the Agat Marina, and the Merizo boat ramp.

Four fisheries staff left the Fisheries office for career advancement at other government agencies during 2002: two biologists, the fisheries technical supervisor, and a fisheries technician. Although a biologist was hired during 2002, the number of surveys at the Agana Boat Basin was decreased due to a lack of adequate staff to provide the necessary coverage for all Fisheries projects. Rather than sample two weekdays and two weekends a month at Agana, sampling was reduced to one weekday and one weekend a month. DAWR plans to hire additional staff during 2003 and reinstate the original sampling regimen at the Agana Boat Basin during fiscal year 2004.

Charter bottomfishing boats still comprise a large proportion of participation and effort. Charter boats operating out of the Agat marina still have as many as two to three trips daily, although heavily dependent on Asian visitors. These boats, however, have been operating in the same area near the marina year after year. A majority of their catch is made up of juvenile goatfish, triggerfish, and groupers, most of which is

discarded as bycatch. Other fish of different genera are rarely seen by these charter boats, such as snappers, wrasses, and emperors. The fishing effort from these boats appears to have added to the overfishing in the immediate area. Gillnetting is often seen in the adjacent reef flat. Large fish are rarely caught but are often kept, and the small juveniles are occasionally kept to serve as sashimi to their guests. These boats appear to include non-fishing activities to supplement their charter trips.

The testing of fish potentially contaminated by PCB around Orote Point was to be completed during 2002. This was not completed, as a more intensive testing regimen was required by the Guam Environmental Protection Agency. The study by the Navy should be completed during 2003 and reported in next year's report. The area originally restricted to fishing has been decreased after preliminary PCB testing.

A significant increase in the number of bad weather days was observed in 2002. Guam was hit by direct hits by Supertyphoon Chata'an in the late spring and by Supertyphoon Pongsona at the beginning of December. The typhoons did significant damage to boats, temporarily closed two major boating access ramps, and virtually eliminated charter fishing. Local fishermen also reported poor catches immediately after both storms. These factors may have caused the significant decrease in bottomfish participation, effort, and catch for the 2002.

Agriculture's Fisheries Section began collecting information on bycatch as part of its offshore creel census at the beginning of 2000 as a requirement of the bottomfish FMP. This will provide information on the effect bottomfishing may have on fish species that are caught but discarded, a practice observed quite frequently with the charter sector, and beginning to be observed with the non-charter sector. The release of small fish back into the marine environment is a small but significant action taken by some fishermen as a response to declining numbers and smaller sizes of preferred food fish.

The demand for both deep and shallow-water bottomfish continues to exceed the locally caught supply. The cultural value of the shallow and deep-water complex remains high due to the popularity of this assemblage of fish as food items, especially during the Lenten season, family gatherings, and large celebrations. Some of the demand for bottomfish is offset with imports from the Philippines and Micronesia. This demand, however, may be contributing to the overall decline in nearshore and reef-associated bottomfish populations.

Bottomfish and BMUS species are also being impacted by other boat-based methods such as spearfishing, and shore-based methods such as gillnetting. Abandoned gillnets is a regular problem on Guam and is known to catch BMUS species, although not a significant number.

Summary

The new offshore creel survey expansion system utilizes a database format to expand the offshore survey data. The new format separates the charter and non-charter components, allows for the distinction between shallow and deep bottomfish complexes, and provides for the collection of bycatch data. This improvement, combined with recent revisions of expansion algorithms, crosschecking features, and size distribution analysis have contributed to the increased efficiency in the production and reliability of the Guam annual reports. These types of data outputs have become important in recent years as overall fish stocks appear to be declining and management decisions are being made based on the voluntary fishery data that is collected. Although complementary statistics of confidence and analysis of biological and species composition data are not possible at this time, DAWR's Fisheries Section is continuing work with the WPacFIN program coordinator to further develop the expansion system to eventually include production of such analyses.

Work was done to integrate the inshore creel census data with the offshore creel census data to obtain a more accurate estimate of BMUS species that are harvested islandwide. This module combined the bottomfish catch from shore-based methods (“inshore catch”) and boat-based methods (“offshore catch”) to obtain a total catch of bottomfish and BMUS species. Also, size distribution for representative fish from the four major bottomfish groups (groupers, emperors, trevallies, and snappers) are provided. This was done to observe if a size decrease is occurring with BMUS and bottomfish species that are harvested. This provides an additional tool to observe the health of bottomfish stocks in addition to looking at total harvest.

The bottomfish fishery data in 1998 indicated that Guam’s aggregate CPUE for all bottomfishing may have been in a “yellow light” condition, an indicator of fishery stress. However, the charter and non-charter components were expanded separately in 1999 and a “yellow light” condition was not observed with the non-charter component. The bottomfish charters, primarily the Agat Marina bottomfish charters, may have skewed the overall CPUE toward a “yellow light” condition due to the high effort and low catch of this component of bottomfishing. Nonetheless, anecdotal evidence from local fishermen and creel census data do show that the bottomfish fishery is stressed. The sizes of bottomfish that are harvested are decreasing, especially those of the shallow water and coral reef complex. Unfortunately, these fish are usually not released despite their small size, although more fishermen are beginning to realize the importance of releasing juvenile fish and less desirable species.

Total and BMUS bottomfish harvest decreased in 2002. Total bottomfish landings decreased 33%, with non-charter decreasing 39%. Charter catch increased 58%, but make up a small portion of the overall harvest. Total BMUS landings decreased 40%, with the non-charter and charter components decreasing 45% and 31% respectively. Offshore made 84% of both the total bottomfish catch and BMUS catch. The CPUE for all bottomfish decreased 21%, while the non-charter and charter CPUE decreased 20% and increased 19% respectively.

The commercial sale of BMUS species decreased 44% in 2002, with the adjusted revenue decreased 46%. The number of fishing vendors selling local fish decreased during 2002, and sales were affected by a lack of electricity and available ice after the supertyphoons. The number of boats bottomfishing, the number of bottomfish trips, and the number of hours spent fishing increased 4%, decreased 44%, and decreased 43% respectively.

Due to Guam’s declining tourist visitor arrivals and declining revenue, subsistence and commercial fishing may increase in order to offset the potential loss of jobs in the government and private sector. Also, Agriculture’s Fisheries section will report data collected at Guam’s fishing preserves to the local legislature in 2003. Local laws, other than those restricting fishing in Guam’s marine preserves, are not pro-active in overall fishery conservation, since there are no size, number, species, or seasonal restrictions. In addition, fires, farming, and clearing activities are responsible for depositing vast amounts of silt on coral reefs every year. During 2002, the Achang Marine preserve allowed the take of seasonal juvenile jacks within the preserve boundaries, decreasing the number of no-take preserves from three to two. Although there is a cultural component for this seasonal harvest, this may negatively impact the preserves intent to restore the stocks of jacks. The Tumon Bay preserve allows for the take of jacks, while the Pati Point preserve allows the take of all species caught by rod and reel from shore, many of which are BMUS and bottomfish species.

Summary of Historical Annual Statistics

Year	Total Bottomfish Landings (lbs)*	CPUE (lbs/hour)	CPI	Adjusted Revenue (\$)	Adjusted Price/lb (\$)	Number of Boats
80			134.0	43,185	4.58	
81			161.4	58,547	5.53	
82	40,080	7.2	169.7	39,672	5.71	154
83	46,976	6.3	175.6	191,591	5.18	106
84	57,197	7.3	190.9	116,281	4.99	144
85	104,526	5.7	198.3	132,451	4.73	161
86	49,748	5.2	203.7	53,836	4.45	118
87	57,806	5.8	212.7	55,581	4.40	139
88	83,668	4.9	223.8	66,882	4.20	198
89	91,201	5.6	248.2	95,820	4.88	223
90	83,334	4.5	283.5	89,398	4.73	226
91	81,491	4.8	312.5	50,915	4.51	246
92	96,692	5.8	344.2	44,257	4.15	236
93	104,044	4.2	372.9	39,742	3.90	360
94	115,473	5.6	436.0	121,000	3.99	298
95	118,576	2.5	459.2	49,037	3.55	402
96	160,196	4.1	482.0	20,332	2.75	408
97	113,945	3.7	489.7	32,273	3.04	332
98	112,181	2.6	487.1	49,251	3.34	354
99	147,837	3.2	496.0	111,387	3.62	411
00	156,853	3.7	505.9	76,854	3.51	312
01	132,260	3.8	499.4	85,424	3.25	337
02	88,740	3.0	502.0	46,145	3.15	351
Average	97,293	4.7	329.9	72,603	4.18	263
Std. dev.	35,078	1.4	138.7	40,358	0.81	102

*includes bottomfish harvest obtained by Inshore Creel survey, except for the years 1982-1984.

Recommendations

Status of 2001 recommendations

1. Integrating the offshore and inshore creel census data and the fine-tuning of the offshore expansion program is ongoing. Invaluable technical assistance from NMFS has enabled DAWR to move closer towards providing statistics of confidence, and analyses of mean fish size, and separation between the shallow and deepwater bottomfish complexes. Inputting the remaining historical offshore data that should have been completed in 2001 is still ongoing. The loss of four fisheries staff during 2002 and an increase in other fisheries projects has delayed this recommendation from being completed during 2002.
2. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. The continual loss of fisheries staff, including senior biologists and the Chief Scientist for that trip, since 2000 and an increase in other fisheries projects have prevented the data from being analyzed.
3. The establishment of mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes has not been completed during 2001, although the offshore expansion program is being fine-tuned and integration of the offshore and inshore creel survey data has began. Guam's offshore coordinator and NMFS Honolulu lab staff continues to make progress towards completing this recommendation.

2002 Recommendations

1. Completing the baseline biological survey of the red-gill emperor, *Lethrinus rubrioperculatus*, remains the single most important data deficiency for the shallow water bottomfish resource for the Mariana Islands. DAWR's fisheries staff has discussed making progress towards completing this study when additional staff is available to ease the workload of the existing staff.
2. DAWR should establish mean fish size, percent immature, and SBB indicators for both deep and shallow water bottomfish complexes. Fine-tuning of this program should be completed in 2003

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**Table 1. Expanded Offshore Creel Survey Composition
Of Bottomfish Management Unit Species (BMUS) for 2002**

Management Unit Species	Total Harvest*(lbs)
Lehi (<i>A. rutilans</i>)	1,376
Uku (<i>A. virescens</i>)	1,170
Ehu (<i>E. carbunculus</i>)	2,531
Onaga (<i>E. coruscans</i>)	5,821
Yellowtail Kalekale (<i>P. auricilla</i>)	1,197
Opakapaka (<i>P. filamentosus</i>)	283
Yelloweye Opakapaka (<i>P. flavipinnis</i>)	756
Gindai (<i>P. zonatus</i>)	697
Ta'ape (<i>L. kasmira</i>)	191
Other Snappers	1,156
Jacks (<i>C. ignobilis</i> , <i>C. lugubris</i>)	1,204
Amberjack (<i>S. dumerili</i>)	29
Other Jacks	3,297
Groupers (<i>C. urodeta</i> , <i>E. fasciatus</i> , <i>V. louti</i>)	2,702
Other Groupers	2,543
Emperors (<i>L. rubrioperculatus</i>)	4,620
Other Emperors	16,039
Total	55,759

*Bottomfishing method only

Table 2. Commercial Bottomfish Average Prices for 2002

Species	Average \$/lb
Amberjack	2.68
Ehu	3.72
Kalikali	3.00
Lehi	3.88
Onaga	4.75
Opakapaka	3.76
Uku	2.56
Gindai	3.88
Black Jack	2.50
Misc. Jacks	2.56
Groupers	2.97
Emperors	2.69
Snappers	2.57
Red Snapper (Tagafi)	2.50

Misc. Bottomfish	2.90
All Bottomfish Species	3.15

Figure 1a. Harvest of All Bottomfish Species

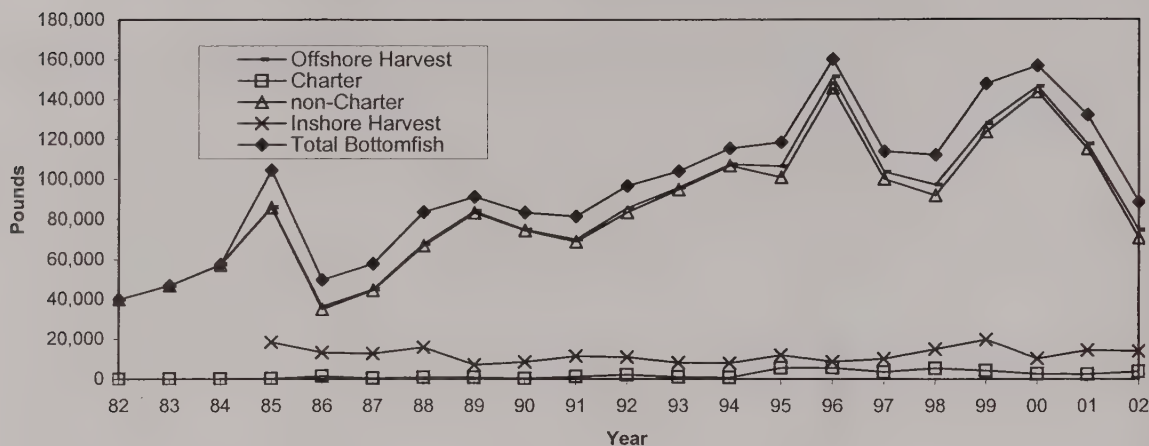
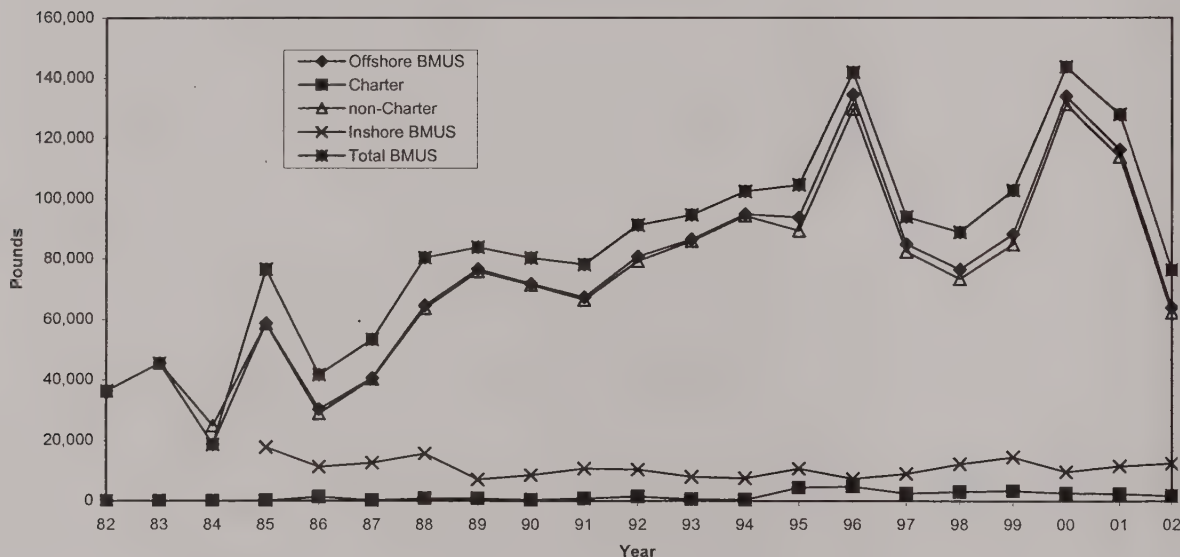


Figure 1b. Harvest of BMUS Species



Interpretations: Historically, annual fluctuations of BMUS landings were usually due to highliners entering or leaving the fishery during a given year. The peak in 1985 of BMUS species harvested was the result of a number of highliner fishermen who fished in 1985 and then left the following year.

In 2002, a decrease in bottomfish and BMUS harvest was observed. Total bottomfish decreased 33%, with the non-charter and charter sectors decreasing 39% and increased 58% respectively. BMUS harvest decreased 40%, with non-charter and charter sectors decreasing 45% and 31% respectively. Offshore methods made up 84% of the total bottomfish and BMUS catch for 2002.

Source: The DAWR offshore creel survey data as expanded by computer-based algorithms by method of fishing. All unidentified catch was allocated to species categories based on the species percentage of the total catch.

Calculations: The estimated total landings of the bottomfish species are selected from the expanded creel survey species composition files. However, the expanded estimates of catch by species must include at least a portion of the catch identified only by generic species codes categories. These generic categories (e.g. assorted/shallow/deep bottomfish) also include some non-BMUS bottomfish according to the FMP definition (e.g. triggerfish, wrasses, goatfish).

Year	Total Bottomfish Harvest (lbs)	Offshore Creel Harvest (lbs)	Inshore Creel Harvest (lbs)	Non-charter Harvest (lbs)	Charter Harvest (lbs)
82	40,080	40,080		40,060	20
83	46,976	46,976		46,976	0
84	57,523	57,523		57,197	0
85	104,526	86,075	18,451	85,887	188
86	49,748	36,441	13,307	34,966	1,475
87	57,806	45,034	12,772	44,576	458
88	83,668	67,773	15,895	66,842	931
89	91,201	84,016	7,185	83,168	848
90	83,334	74,718	8,616	74,334	384
91	81,491	69,985	11,506	68,739	1,246
92	96,692	85,657	11,035	83,476	2,181
93	104,044	95,887	8,157	94,838	1,049
94	115,473	107,512	7,961	106,757	755
95	118,576	106,561	12,015	100,980	5,581
96	160,196	151,444	8,752	145,769	5,674
97	113,945	103,707	10,238	100,099	3,607
98	112,181	97,187	14,994	91,745	5,442
99	147,837	128,008	19,829	123,678	4,330
00	156,853	146,481	10,372	143,808	2,673
01	132,260	117,735	14,525	115,252	2,482
02	88,840	74,655	14,085	70,724	3,931
Average	97,293	86,831	12,205	84,756	2,060
Std. deviation	35,078	32,822	3,618	31,587	1,956

Year	Total BMUS Harvest (lbs)	Offshore Creel Harvest (lbs)	Inshore Creel Harvest (lbs)	Non-charter BMUS Harvest (lbs)	Charter BMUS Harvest (lbs)
82	36,449	36,449		36,429	20
83	45,609	45,609		45,609	0
84	18,707	18,707		24,884	0
85	76,623	58,816	17,807	58,643	174
86	41,775	30,411	11,364	28,936	1,475
87	53,430	40,722	12,708	40,410	311
88	80,422	64,696	15,726	63,764	931
89	83,844	76,678	7,166	75,831	848
90	80,353	71,791	8,562	71,437	354
91	78,159	67,358	10,801	66,464	894
92	91,275	80,826	10,449	79,287	1,539
93	94,659	86,595	8,064	85,930	665
94	102,452	94,886	7,566	94,316	470
95	104,629	93,875	10,754	89,392	4,483
96	142,022	134,624	7,398	129,819	4,805
97	94,015	84,946	9,069	82,381	2,565
98	88,899	76,580	12,319	73,412	3,168
99	102,801	88,258	14,543	84,830	3,428
00	143,707	133,984	9,723	131,311	2,673
01	128,025	116,386	11,639	113,904	2,492
02	76,434	63,971	12,463	62,252	1,720
Average	84,014	74,579	11,007	73,297	1,572
Std. deviation	32,533	30,971	2,954	29,432	1,480

Figure 2a. Total and Commercial BMUS Harvest

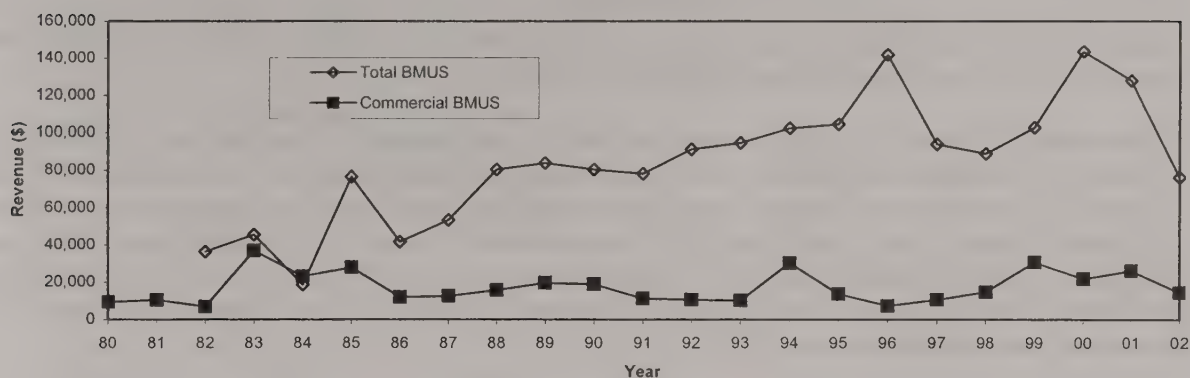
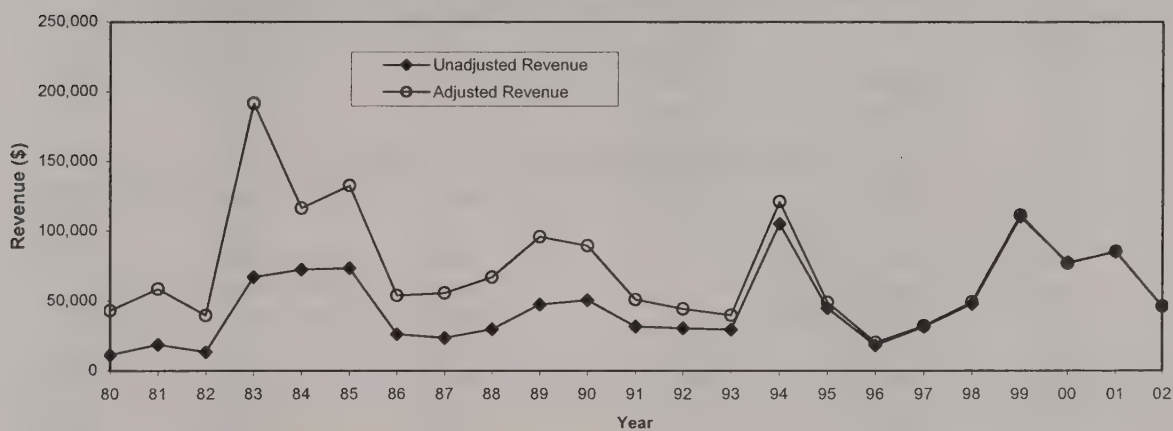


Figure 2b. Commercial BMUS Revenue



Interpretations: Highliners have been responsible for the peaks in the commercial BMUS landings, especially in 1983, 1985, 1994, 1998, and 1999. The threefold increase in the commercial BMUS harvest and revenue in 1994 was the result of highliner vessels entering into the fishery that year. The 39% reduction in BMUS harvest and 56% decline in commercial harvest for 1995 is best explained by the absence or reduced effort of approximately six highliners who were responsible between 1992 and 1996 for 18% of the total BMUS harvests between 1992 and 1996, and 68% of the unexpanded commercial landings. Harvest records for these highliners indicate a 45% reduction in 1995 of their total bottomfish harvest, dropping from 13,349 pounds in 1994, down to 6,023 pounds in 1995. This decline in highliner landings accounts for about two-thirds of the 1995 reduction in commercial BMUS harvest.

The peak in 1996 followed by a 46% decline the following year in total BMUS harvest is believed to have been influenced more by weather conditions than any other factor. In 1997, storms decreased the number of calm fishing days.

In 2002, there were two direct hits by supertyphoons and an increase in the number of bad weather days that

decreased bottomfishing. Total BMUS harvest decreased 40%, with the commercial harvest decreasing 44%. Adjusted revenue decreased 46%.

Source: The estimated total landings are from the DAWR creel survey system, and the commercial data are from the WPacFIN-originated commercial landings system.

Calculations: The total commercial bottomfish landings and revenue for each year were calculated by summing the weight and value fields in the commercial landings database and then multiplying by an estimated percent coverage expansion factor. This annual expansion factor was subjectively created and includes an analysis of the "disposition of catch" data available from the DAWR offshore creel survey, an evaluation of the fishermen in the fishery and their entry and exit patterns, general dockside knowledge of the fishery, status of marketing conditions and its structure, overall number of records in the data base, and a measure of best educated guesses.

Year	Total BMUS Harvest (lbs)*	Commercial BMUS Harvest (lbs)	Unadjusted Revenue (\$)	Adjusted Revenue (\$)
80		9,434	11,528	43,185
81		10,596	18,825	58,547
82	36,449	6,947	13,412	39,672
83	45,609	36,984	67,013	191,501
84	18,707	23,291	72,349	116,281
85	76,623	28,028	73,438	132,451
86	41,775	12,110	26,219	53,836
87	53,430	12,639	23,551	55,581
88	80,422	15,933	29,818	66,882
89	83,844	19,630	47,365	95,820
90	80,353	18,916	50,479	89,398
91	78,159	11,278	31,703	50,915
92	91,275	10,668	30,355	44,257
93	94,659	10,191	29,526	39,742
94	102,452	30,356	105,126	121,000
95	104,629	13,815	44,865	49,037
96	142,022	7,389	18,229	20,332
97	94,015	10,621	31,485	32,273
98	88,899	14,737	47,770	49,251
99	102,801	30,757	110,066	111,387
00	143,707	21,924	77,474	76,854
01	128,025	26,289	84,999	85,424
02	76,434	14,639	46,145	46,145
Average	84,014	17,268	47,467	72,603
Std. deviation	32,533	8,432	28,465	40,358

*includes harvest from Inshore Creel Survey

Figure 3a. Estimated Bottomfish Boat Hours

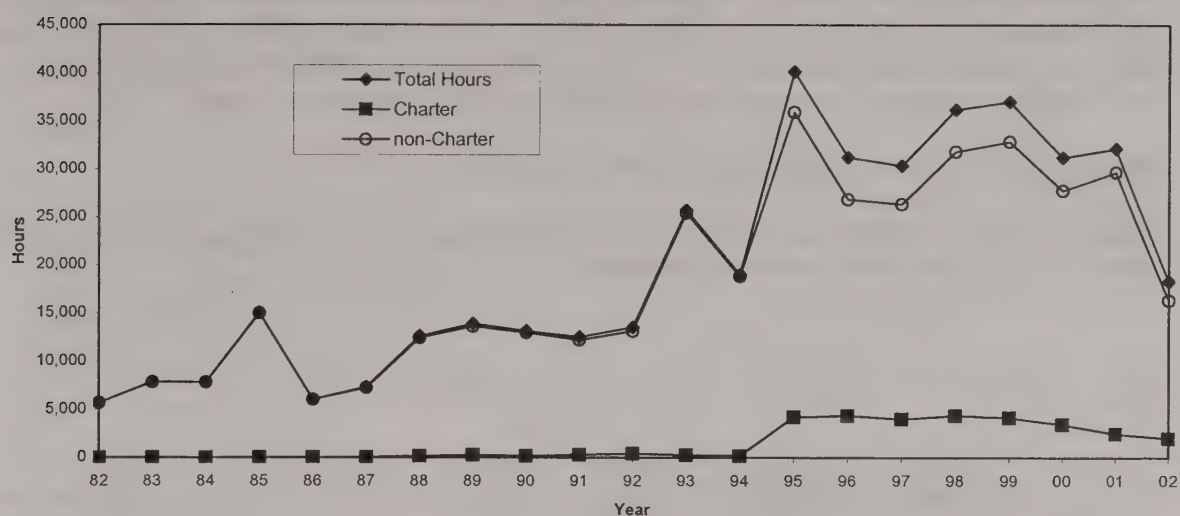
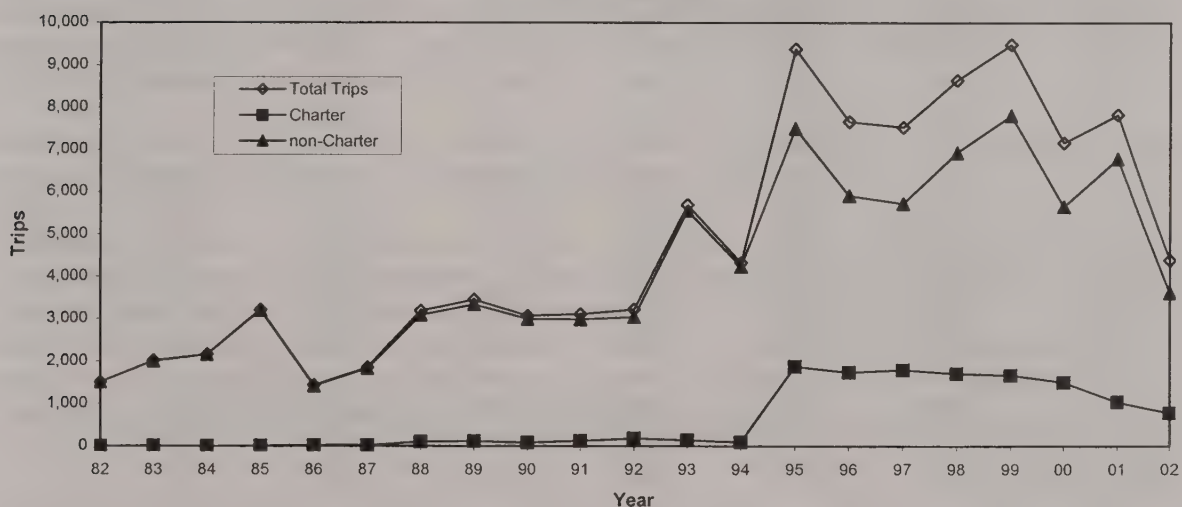


Figure 3b. Estimated Bottomfish Trips



Interpretations: The threefold increase in boating hours and doubling of bottomfish trips in 1995 may have been due to the 60% increase in the number of boats entering the fishery that year, the number of calm days that year compared with previous years, and the inclusion of the Agat Marina into the offshore survey in 1994. That year, the charter boat component of the bottomfish fishery accounted for 23% of the total number of bottomfishing trips and 13% of the hours fished. This increase was due to several charter bottomfishing vessels operating out of Agat that made multiple trips on each survey day. The number of charter trips decreased after 1997, possibly due to tourists participating in less expensive types of recreation. The slight declines in bottomfishing trips and hours in 1996 and 1997 were due to a number of typhoons that hit Guam

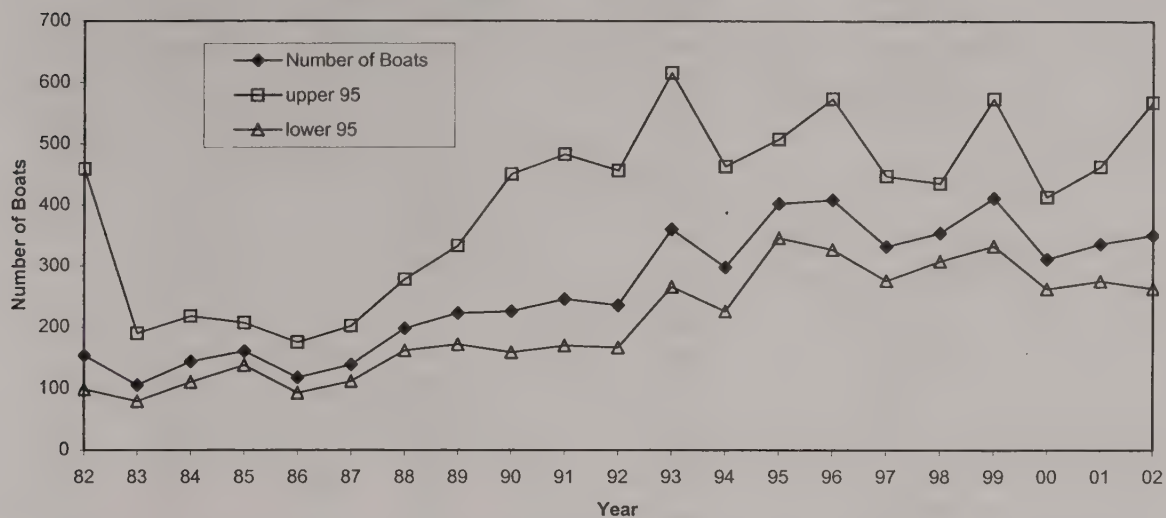
those years. A return to more normal weather patterns in 1999 best explains the increases that year. The decreases in boating hours and trips observed in 2000 could be due to fishermen dropping out of the fishery due to poor catches in the shallow bottom complex. In 2002, overall hours and trips decreased significantly, 43% and 44% respectively, with non-charter hours and trips decreasing 45% and 47% respectively. The charter hours and trips also decreased, significantly 18% and 25% respectively. This sector, which is tourist dependent, continues to decrease due to a decrease in tourist numbers, a shift to less expensive activities by tourists, and the number of storms preventing tourists from visiting Guam year round.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: The estimated number of boat trips and boat hours for bottomfishing methods are derived directly from the creel survey expansion algorithms.

Year	Total Hours	Non-charter hours	Charter hours	Total Trips	Non-charter trips	Charter trips
85	15,037	14,989	48	3,212	3,201	11
86	6,058	6,033	25	1,444	1,422	23
87	7,313	7,264	49	1,857	1,835	22
88	12,611	12,435	176	3,190	3,085	105
89	13,910	13,615	295	3,452	3,338	114
90	13,143	12,967	176	3,071	2,988	83
91	12,527	12,217	310	3,109	2,986	123
92	13,550	13,138	412	3,234	3,054	180
93	25,733	25,458	275	5,692	5,551	141
94	19,038	18,849	189	4,331	4,238	93
95	40,153	35,927	4,226	9,376	7,498	1,878
96	31,249	26,863	4,386	7,657	5,912	1,745
97	30,370	26,360	4,010	7,527	5,724	1,803
98	36,198	31,822	4,376	8,636	6,924	1,712
99	37,019	32,860	4,159	9,479	7,804	1,675
00	31,216	27,760	3,457	7,159	5,654	1,505
01	32,140	29,665	2,428	7,820	6,783	1,038
02	18,357	16,357	2,000	4,387	3,613	774
Average	19,858	18,378	1,480	4,777	4,156	621
Std. deviation	11,440	9,817	1,820	2,736	2,052	759

Figure 4. Bottomfish Fishery Participation



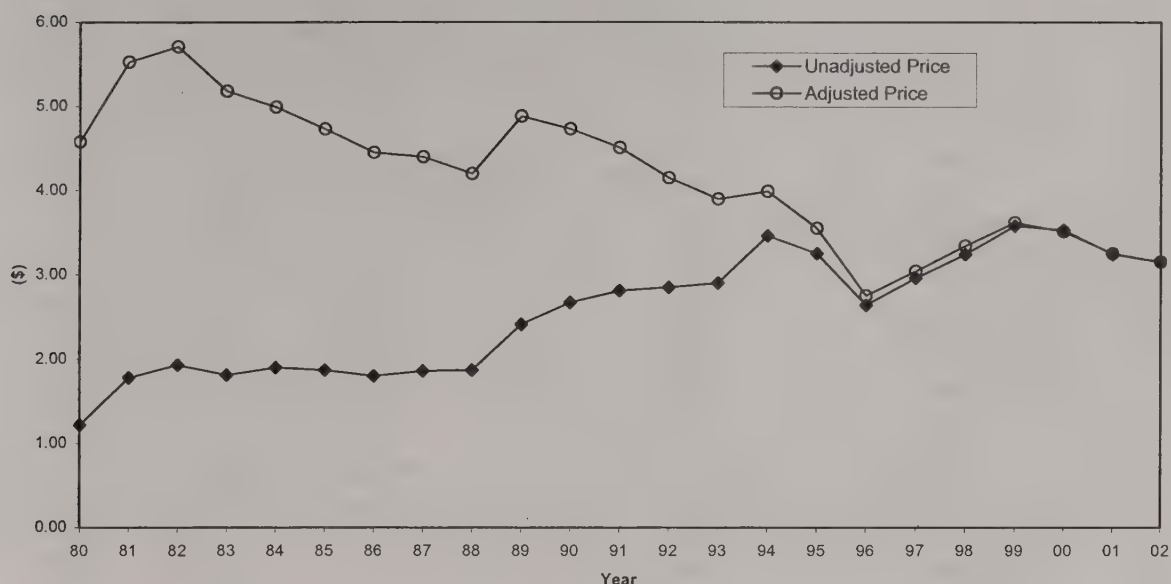
Interpretations: The number of boats participating in this fishery has leveled off in recent years, but generally increases during years having ideal weather conditions, available marketing opportunities, and a thriving economy. The 57% increase in participation from 1992 and 1993 could be due to the inclusion of the Merizo Pier as a survey site, as well as a healthy economy that made it possible for more residents to afford boats. Another 57% increase occurred in 1995 due to the inclusion of the Agat Marina as an offshore creel survey site in October 1994. Although two major storms damaged boats during 2002, the number of unique boats bottomfishing increased slightly at 4%.

Source: Offshore creel survey boat log data from DAWR's three sampled ports. The data was converted and processed using the WPacFIN-generated boat estimator model.

Calculations: The 2002 figure was obtained by first running the above-mentioned model 1,000 times using a randomly selected order of the days sampled at all three ports combined, then eliminating the upper and lower 25 estimates to rid the model of occasional outlier estimates; and finally calculating the mean and standard deviation for the remaining 950 estimates. The removal of the outliers conducted in the second step lowered the original estimated number of boats after the model was run 1,000 times by about 1%, but more important, reduced the standard deviation by approximately 20%.

Year	Lower95	Number of boats	Upper 95
82	99	154	459
83	80	106	190
84	111	144	218
85	138	161	207
86	93	118	175
87	112	139	202
88	162	198	278
89	172	223	333
90	159	226	450
91	170	246	482
92	167	236	456
93	266	360	615
94	226	298	463
95	346	402	507
96	327	408	573
97	276	332	447
98	308	354	435
99	333	411	573
00	263	312	413
01	276	337	463
02	264	351	568
Average	207	263	405
Std. Deviation	87	102	141

Figure 5. Average Bottomfish Prices



Interpretations: The decreases in adjusted fish prices observed prior to 1996 may have been the result of a consistent supply of reasonably priced fish and competition among vendors during those years. Roadside vendors importing fish from other islands competed with and may have discouraged local vendors from increasing the price of locally caught bottomfish. These roadside vendors were shut down by the Department of Public Health due to health concerns, which resulted in the rise of locally caught bottomfish prices since less expensive fish from Micronesia could not be easily imported. However, fish from Micronesia and the Philippines is allowed to enter the local market, competing with locally caught fish. The adjusted average price for bottomfish has been increasing slightly from 1996 to 1999, and could likely have been the result of increased demand for a dwindling supply of locally caught fish. A slight decrease in fish prices occurred in 2002, decreasing 3%.

Source: The commercial landings data from the major wholesalers.

Calculations: The average price of all bottomfish species combined is calculated by dividing the total bottomfish revenue by the sold weight. The inflation adjustment is made by using the Consumer Price Index (CPI) for Guam and establishing the 1998 figure as the base from which to calculate expansion factors for all previous years (e.g. divide the 1998 CPI by the CPI for any given year), and then multiplying the unadjusted average price by this factor to obtain the adjusted average price for the given year. A new “market basket” was created by the Department of Commerce in 1998, which resulted in the CPI figure being reset in 1999. The CPI and CPI Adjustment Factor was 499.4 and 1.01 for 2001, and 502.00 and 1.00 for 2002 respectively.

Year	Unadjusted Price \$/lb	Adjusted Price \$/lb
80	1.22	4.58
81	1.78	5.53
82	1.93	5.71
83	1.81	5.18
84	1.90	4.99
85	1.87	4.73
86	1.80	4.45
87	1.86	4.40
88	1.87	4.20
89	2.41	4.88
90	2.67	4.73
91	2.81	4.51
92	2.85	4.15
93	2.90	3.90
94	3.46	3.99
95	3.25	3.55
96	2.64	2.75
97	2.96	3.04
98	3.24	3.34
99	3.58	3.62
00	3.53	3.51
01	3.24	3.25
02	3.15	3.15
Average	2.55	4.18
Std.deviation	0.70	0.81

Figure 6a. CPUE: Overall, Charter, and Non-charter

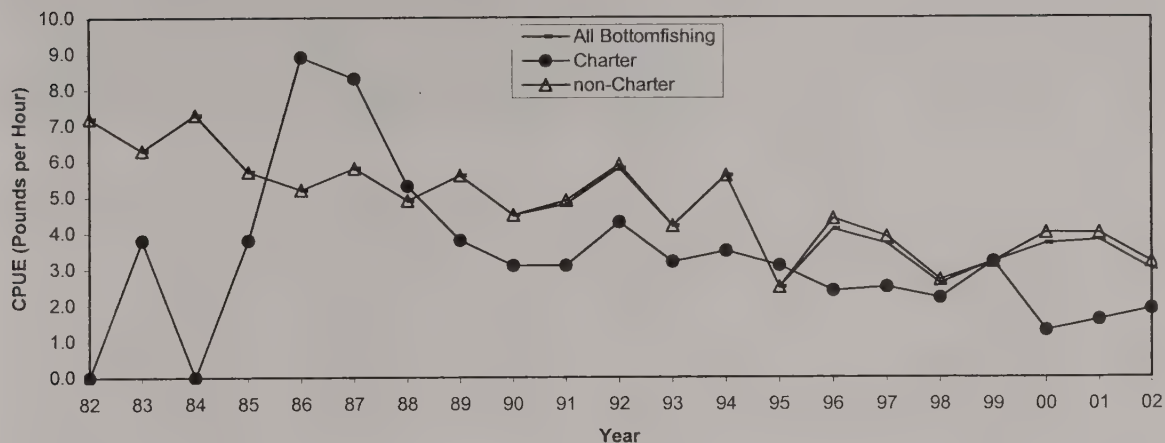


Figure 6b. Deepwater CPUE: Overall, Charter, and Non-charter

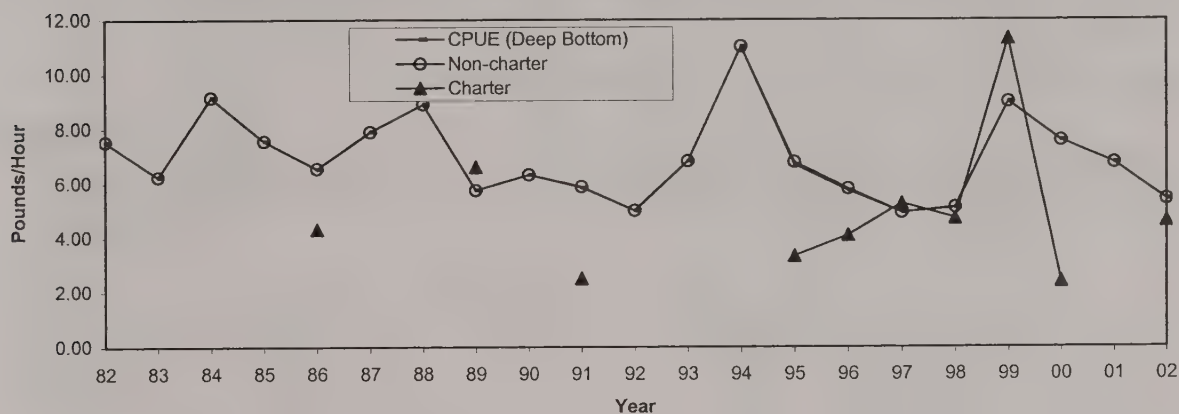
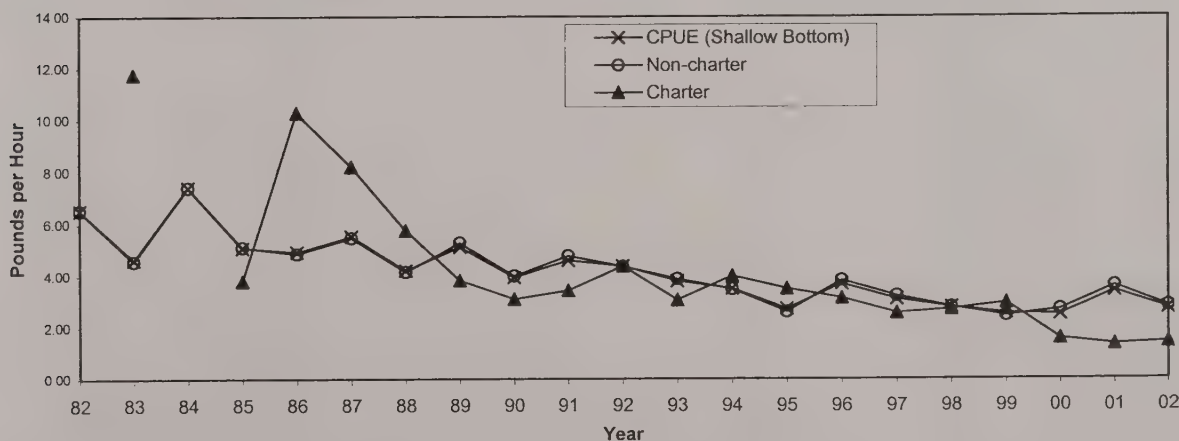


Figure 6c. Shallow Water CPUE: Overall, Charter, and Non-charter



Interpretations: Prior to 1999, the CPUE for bottomfishing was reported as a single value. Because of yellow light situations in 1995 and 1998, the fishery was divided into charter and non-charter components. This was done to separate out the activity of charter boats in Agat that had high effort and low catches that may have skewed the overall CPUE. These boats would sometimes have over 30 guests and fish in the same area year after year, resulting in poor catch rates. Separating out the charter fishing resulted in a CPUE value more representative of bottomfishing.

Historically, CPUE fluctuated between 4-6 pounds per hour and has, until the last five years, remained fairly stable. In 1995 and 1998, the overall and non-charter CPUE fell below 2.8 pounds per hour, due to an increase in the number of recreational and subsistence-type vessels entering the fishery; most of which target the shallow-water bottomfish complex. Both 1995 and 1998 CPUE figures were less than a half of the aggregate CPUE average of 5.6 pounds per hour for the first three years reported using the new expansion system, placing the fishery in yellow light conditions those years. This indicates stress on the fishery, despite the rise in CPUE since 1999. A significant decrease in overall CPUE was observed in 2002, 21%. The charter CPUE increased 19% while the CPUE for non-charter boats decreased 20%. The 2001 CPUE values for all these CPUE values are still well below the 21-year average. For deep bottomfishing, overall and non-charter CPUE decreased 20%. For shallow bottomfishing, overall CPUE decreased 20%, non-charter CPUE decreased 22%, and charter CPUE increased 7%.

Source: The DAWR creel survey data for the bottomfishing method.

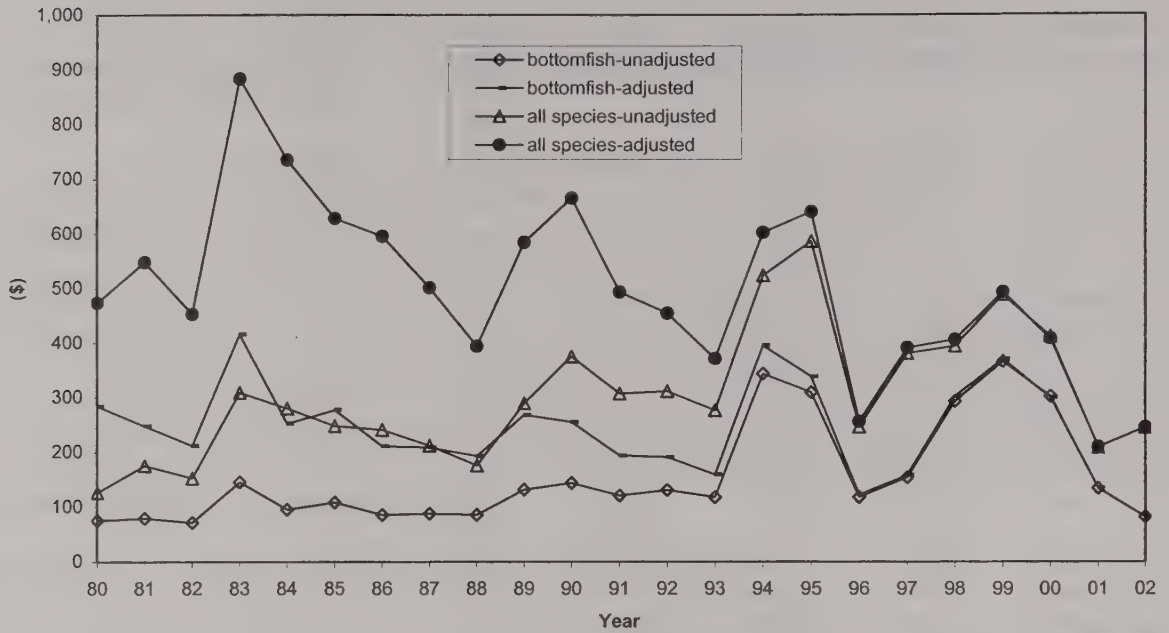
Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	Catch per Unit Effort (lbs/hr)		
	All Bottomfishing	Non-charter	Charter
82	7.2	7.2	0
83	6.3	6.3	3.8
84	7.3	7.3	0
85	5.7	5.7	3.8
86	5.2	5.2	8.9
87	5.8	5.8	8.3
88	4.9	4.9	5.3
89	5.6	5.6	3.8
90	4.5	4.5	3.1
91	4.8	4.9	3.1
92	5.8	5.9	4.3
93	4.2	4.2	3.2
94	5.6	5.6	3.5
95	2.5	2.5	3.1
96	4.1	4.4	2.4
97	3.7	3.9	2.5
98	2.6	2.7	2.2
99	3.2	3.2	3.2
00	3.7	4.0	1.3
01	3.8	4.0	1.6
02	3.0	3.2	1.9

Average	4.7	4.8	3.3
Std.deviation	1.4	1.3	2.2

Year	Deep Bottom	Non-charter CPUE	Charter CPUE	Shallow Bottom	Non-charter CPUE	Charter CPUE
82	7.54	7.54		6.54	6.54	
83	6.24	6.24		4.63	4.57	11.76
84	9.16	9.16		7.41	7.41	
85	7.56	7.56		5.09	5.12	3.81
86	6.54	6.55	4.32	4.94	4.87	10.28
87	7.91	7.91		5.54	5.48	8.22
88	8.91	8.91		4.22	4.16	5.77
89	5.76	5.75	6.61	5.13	5.29	3.84
90	6.32	6.32		3.95	4.00	3.11
91	5.85	5.88	2.51	4.60	4.78	3.44
92	5.00	5.00		4.38	4.37	4.38
93	6.82	6.82		3.80	3.88	3.07
94	11.02	11.02		3.51	3.48	4.00
95	6.68	6.78	3.33	2.73	2.61	3.51
96	5.73	5.80	4.09	3.69	3.83	3.15
97	4.93	4.92	5.26	3.10	3.23	2.57
98	5.10	5.12	4.72	2.79	2.80	2.71
99	9.00	8.74	11.31	2.56	2.46	2.96
00	7.58	7.66	2.40	2.51	2.70	1.57
01	6.76	6.76		3.41	3.61	1.34
02	5.41	5.47	4.62	2.73	2.82	1.43
Average	6.9	7.0	4.9	4.4	4.2	4.3
Std. deviation	1.6	1.6	2.6	1.3	1.3	2.9

Figure 7. Average Revenue per Trip



Interpretations: The 2002 inflation-adjusted average revenue per trip for the “bottomfish” and “all species” categories decreased 40% and increased 17% respectively. Decreases in revenue in previous years were due to several highliners selling their catch to vendors not participating the commercial receipt book program, and an increase in the amount of imported bottomfish from Micronesia that began around 1991 with the addition of frequent airline routes to Guam. The increase in the inflation-adjusted average revenue per trip in 1994 is best explained by the success of a few highliner vessels during that year. Locally caught bottomfish has an advantage with marketing due to the closure of roadside vendors selling imported fish and a preference to purchase locally caught fish.

Source: The commercial landings data from vendors participating in Fisheries’ commercial receipt book program.

Calculations: The average revenue per trip for all species is calculated by summing the revenue of all species sold for any trip that landed bottomfish species, and dividing by the number of trips. The average bottomfish revenue per trips is calculated from those same trips by summing the sales of only bottomfish species and dividing by the number of trips.

Year	\$/Trip, Unadjusted Bottomfish	\$/Trip, Adjusted Bottomfish	\$/Trip, Unadjusted All Species	\$/Trip, Adjusted All Species
80	76	284	127	474
81	80	248	176	548
82	72	212	153	453
83	146	416	309	883
84	96	252	280	735
85	109	277	248	628
86	86	211	241	595
87	88	209	212	501
88	86	193	176	394
89	132	268	289	584
90	144	255	375	665
91	121	194	307	493
92	131	191	311	454
93	118	159	276	371
94	343	395	523	602
95	309	338	586	640
96	118	123	246	256
97	154	158	381	391
98	293	302	394	406
99	366	370	488	493
00	302	300	412	408
01	134	135	209	210
02	82	82	245	245
Average	156	242	303	497
Std. deviation	94	87	119	160

Figure 8a. Jacks/Trevallys (*Caranx, Carangoides*): Harvest

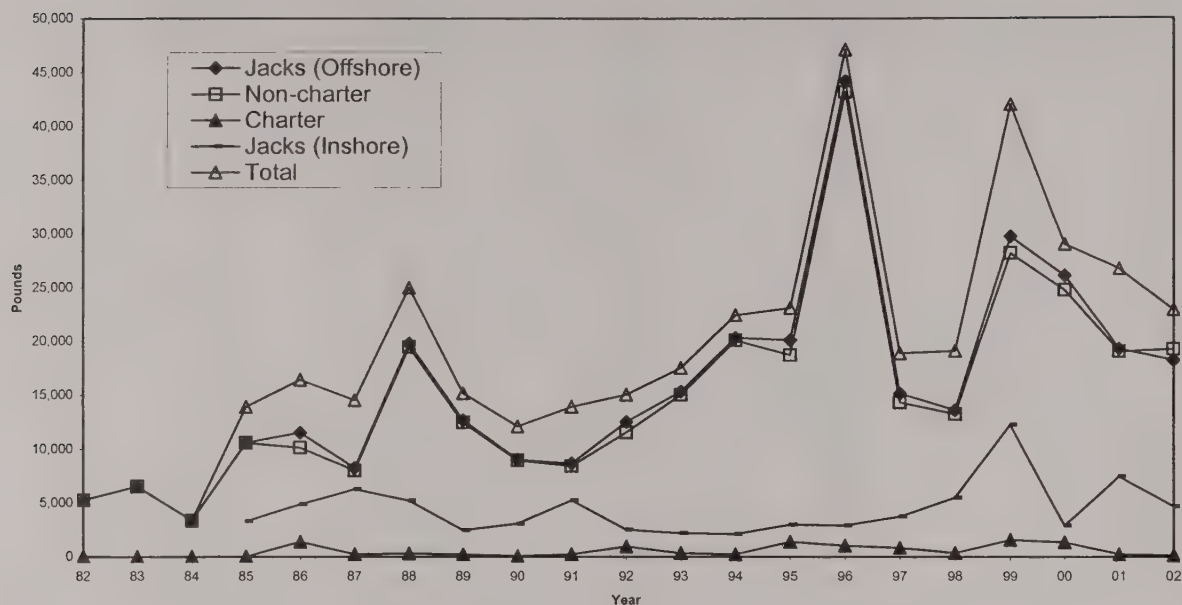


Figure 8b. Jacks/Trevallys (*Caranx, Carangoides*): CPUE

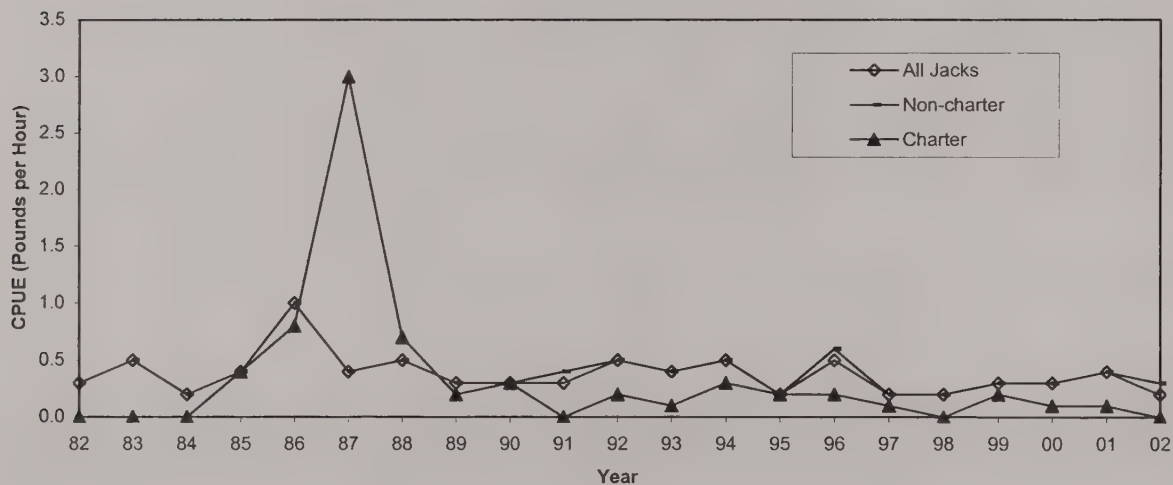


Figure 8c. Average Size Harvested: *Caranx melampygus*

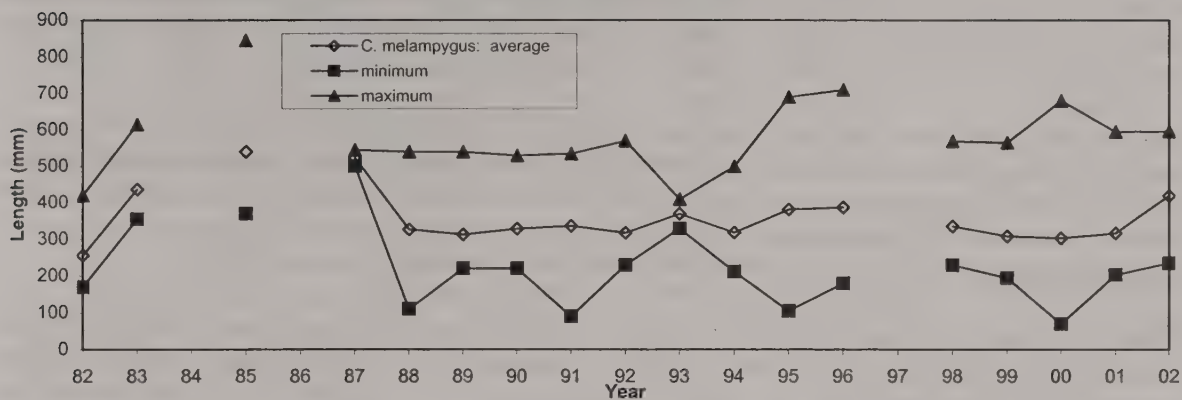


Figure 8d. Average Size Harvested: *Caranx ignobilis*

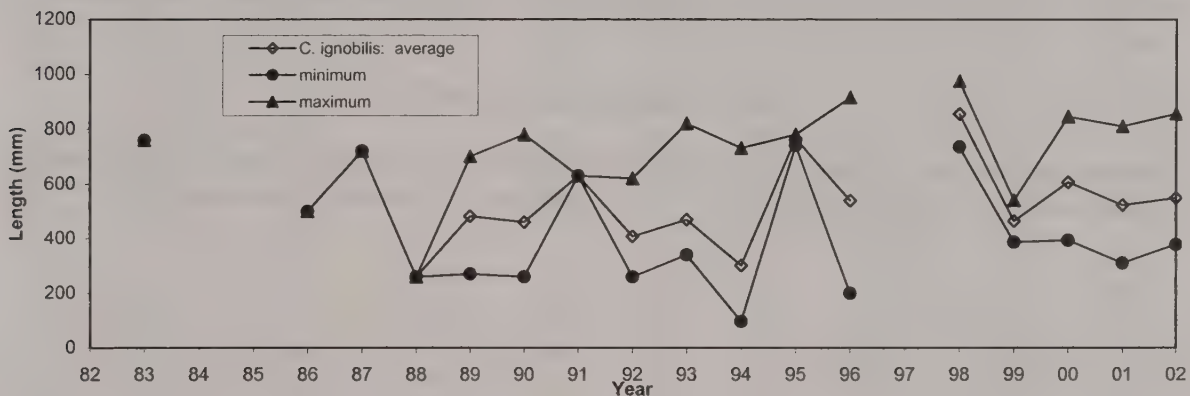
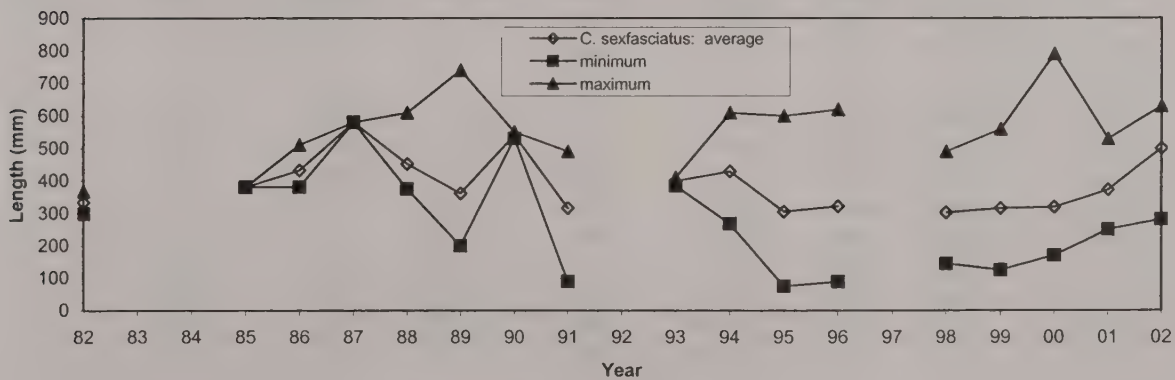


Figure 8e. Average Size Harvested: *Caranx sexfasciatus*



Interpretations: The total, non-charter, and charter harvest of jacks decreased 14%, increased 2%, and decreased 45% respectively in 2002. Total and non-charter CPUE decreased 50% and 25% respectively, with charter CPUE becoming almost negligible. It is hoped that the establishment of the marine preserves on Guam can lead to the increase in number and size of jacks harvested. Juvenile jacks are harvested as a seasonal fishery, making this species of fish targeted during most of its lifespan. The harvesting of juvenile jacks was allowed at the Achang Bay preserve during 2002, which may allow for their take in other preserves. In 2002, offshore fisheries accounted for 80% of the harvest of jacks.

The charter harvest shows extreme fluctuations prior to 1995, then increased fivefold in 1995 with the inclusion of the Agat Marina bottomfish charter boats. Extreme fluctuations in charter harvest and charter CPUE is a reflection of the charter activity in Agat, which account for over 80% of the bottomfish charter activity. These charter boats have high effort, low catches, and fish primarily in the same area over the years, and their low CPUE values in recent years may be an indication of overfishing.

The average size of the three (3) species of jacks over the 21 year period vary show either year-to-year fluctuations or little change. The average size for *C. melampyrgus* shows less fluctuation, but the average size for 2002 is larger than the 21-year average. The average size for *C. ignobilis* shows greater fluctuations, but the average size in 2002 is similar to the 21-year average. The average size for *C. sexfasciatus* shows less fluctuation than *C. ignobilis*, but the average size in 2002 is significantly larger than the 21-year average. The average maximum sizes for all three jacks were larger in 2002 than the 21-year average, with the average minimum sizes varying.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of jacks landed by the total number of hours spent bottomfishing.

Year	Total Harvest	Offshore Harvest	Offshore Non-charter	Offshore Charter	Inshore Harvest	CPUE All Jacks	CPUE Non-charter	CPUE Charter
82	5,300	5,300	5,280	20		0.3	0.3	0
83	6,557	6,557	6,557	0		0.5	0.5	0
84	3,387	3,387	3,387	0		0.2	0.2	0
85	13,925	10,612	10,577	35	3,313	0.4	0.4	0.4
86	16,418	11,529	10,126	1,404	4,889	1.0	1.0	0.8
87	14,509	8,241	7,997	244	6,267	0.4	0.4	3.0
88	24,975	19,764	19,443	321	5,211	0.5	0.5	0.7
89	15,153	12,680	12,454	226	2,473	0.3	0.3	0.2
90	12,096	9,006	8,944	62	3,090	0.3	0.3	0.3
91	13,905	8,660	8,420	240	5,245	0.3	0.4	0
92	15,031	12,508	11,546	962	2,523	0.5	0.5	0.2
93	17,501	15,311	14,984	327	2,190	0.4	0.4	0.1

94	22,418	20,304	20,067	238	2,114	0.5	0.5	0.3
95	23,072	20,082	18,700	1,382	2,990	0.2	0.2	0.2
96	47,093	44,186	43,153	1,032	2,907	0.5	0.6	0.2
97	18,865	15,130	14,301	828	3,735	0.2	0.2	0.1
98	19,084	13,592	13,233	359	5,492	0.2	0.2	0
99	41,986	29,732	28,166	1,566	12,254	0.3	0.3	0.2
00	28,996	26,095	24,753	1,342	2,901	0.3	0.3	0.1
01	26,742	19,277	19,039	238	7,465	0.4	0.4	0.1
02	22,939	18,252	19,267	132	4,687	0.2	0.3	0.0
Average	19,521	15,598	15,056	522	4,430	0.4	0.4	0.3
Std. deviation	10,716	9,588	9,266	536	2,480	0.2	0.2	0.6

Year	<i>C.melampyrgus</i> (average)	<i>C. melampyrgus</i> (min)	<i>C.melampyrgus</i> (max)	<i>C.ignobilis</i> (average)	<i>C.ignobilis</i> (min)	<i>C.ignobilis</i> (max)	<i>C.sexfasciatus</i> (average)	<i>C.sexfasciatus</i> (min)	<i>C.sexfasciatus</i> (max)
82	256	170	420				334	299	368
83	437	355	615	760	760	760			
84									
85	540	370	845				380	380	380
86				500	500	500	432	380	510
87	523	500	545	720	720	720	580	580	580
88	327	110	540	260	260	260	452	375	610
89	313	220	540	482	270	700	361	200	740
90	329	220	530	460	260	780	540	530	550
91	337	90	535	630	630	630	316	90	490
92	318	230	570	408	260	620			
93	370	330	410	469	340	820	399	385	410
94	319	212	500	301	97	730	429	268	610
95	382	105	690	765	740	780	305	75	600
96	388	180	710	539	200	915	322	89	620
97									
98	336	230	569	855	735	975	303	145	490
99	309	195	565	464	387	540	316	125	560
00	304	70	680	606	394	845	319	170	790
01	318	204	595	522	310	810	372	250	529
02	420	236	596	548	378	855	500	281	630
Average	363	224	581	546	426	720	392	272	557
Std. deviation	76	109	103	162	214	172	86	152	113

Figure 9a. Snappers (*Lutjanus*, *Pristipomoides*, *Aphareus*, *Etelis*): Harvest

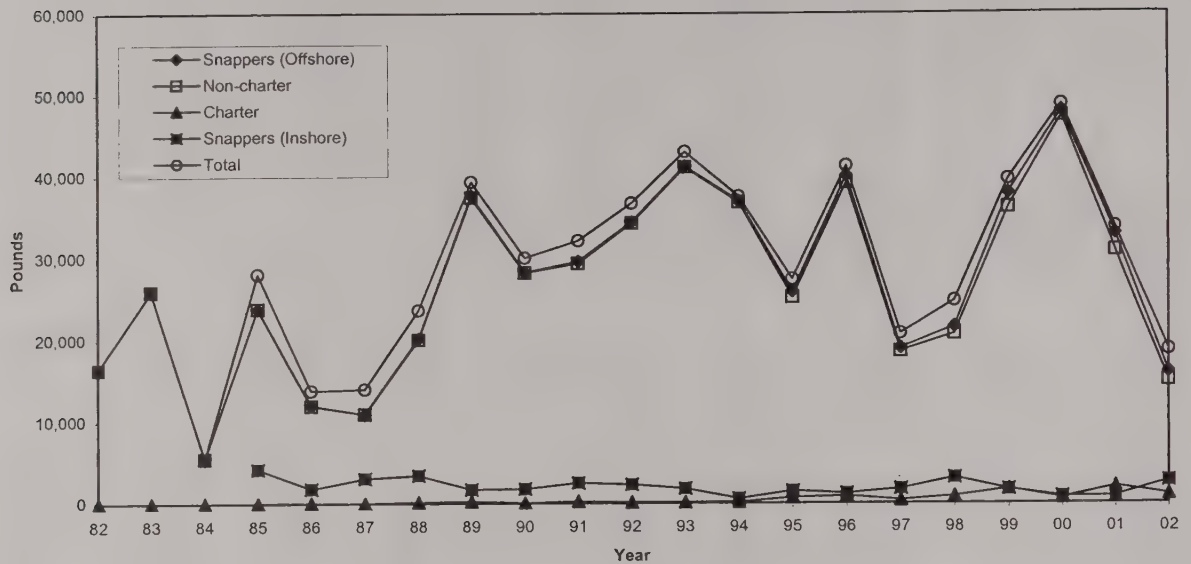


Figure 9b. Snappers (*Lutjanus*, *Pristipomoides*, *Aphareus*, *Etelis*): CPUE

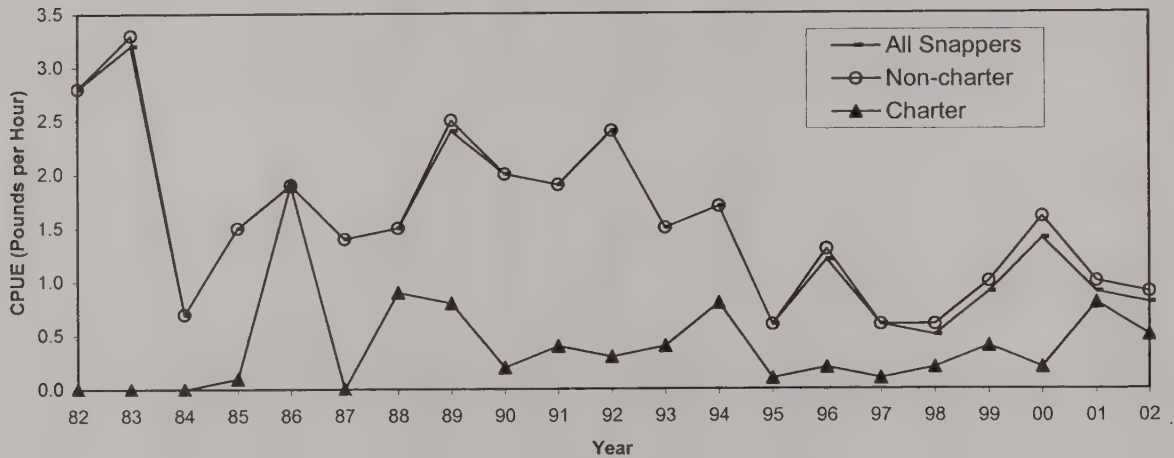


Figure 9c. Average Size Harvested: *Etelis carbunculus*

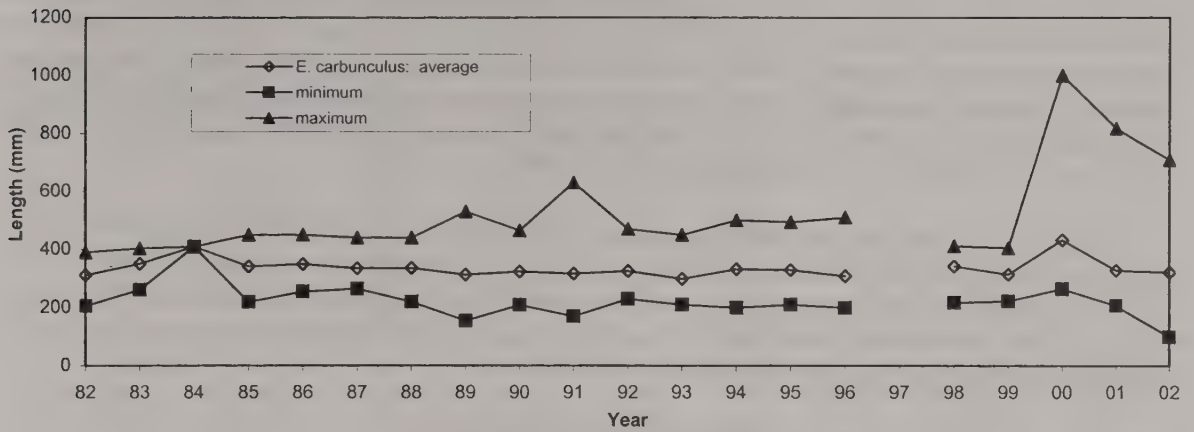


Figure 9d. Average Size Harvested: *Lutjanus kasmira*

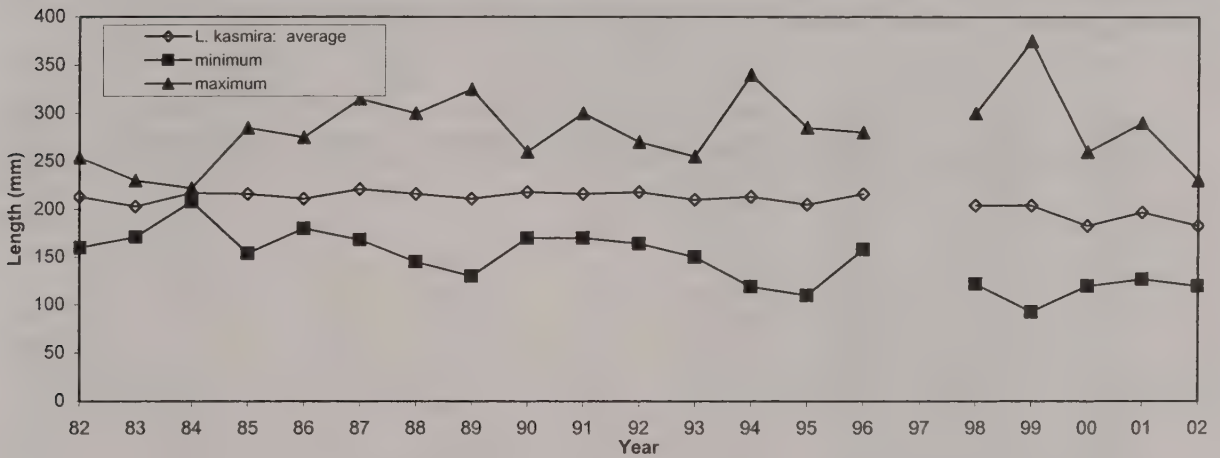
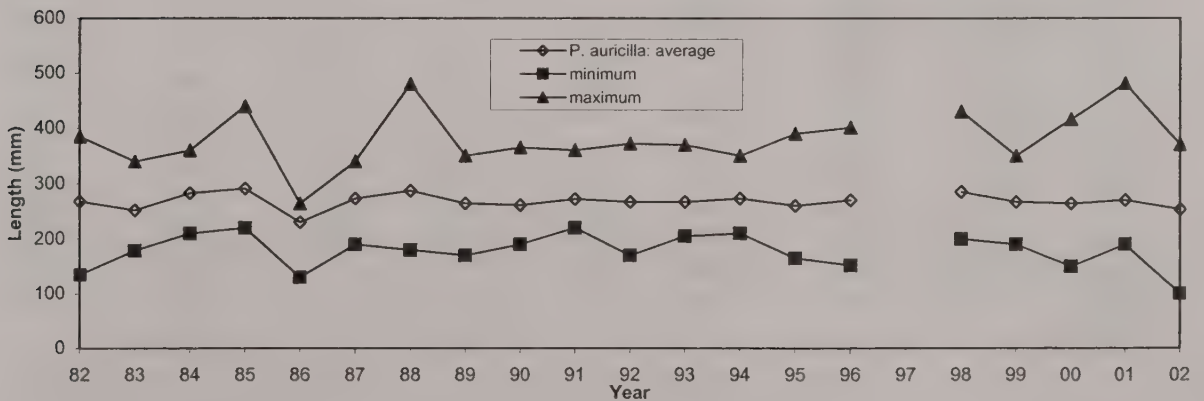


Figure 9e. Average Size Harvested: *Pristipomoides auricilla*



Interpretations: The total, non-charter, and charter harvest of snappers decreased 44%, 51%, and 49% respectively in 2002. The total, non-charter, and charter CPUE decreased 11%, 10%, and 38% respectively. The overall harvest of snappers appeared to be increasing over time, although decreased in harvest were observed the past several years. CPUE, however, appears to show a decreasing trend. The harvest of deepwater snappers is increasing compared with shallower species. Catches of deepwater snappers appear to be interviewed more frequently, as these fishermen usually return during creel census hours. Offshore fisheries made up 85% of the total snapper harvest for 2002.

The average sizes for the three selected snapper species appear to have remained relatively constant for the past 21 years, even with the inclusion of Merizo boat ramp and the Agat marina. Two of the three snapper species are considered deepwater snappers, with both species having 2002 average sizes within one standard deviation. The third snapper species (*L. kasmira*) also shows a relatively constant average size, yet its average size for the past three years has fallen below 200 mm.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of snappers landed by the total number of hours spent bottomfishing.

Year	Total Harvest	Offshore Harvest	Offshore Non-charter	Offshore Charter	Inshore Harvest	CPUE Offshore	CPUE Non-charter	CPUE Charter
82	16,472	16,472	16,472	0		2.8	2.8	0.0
83	25,945	25,945	25,945	0		3.2	3.3	0.0
84	5,475	5,475	5,475	0		0.7	0.7	0.0
85	28,069	23,833	23,830	4	4,236	1.5	1.5	0.1
86	13,845	12,029	11,983	46	1,816	1.9	1.9	1.9
87	14,009	10,951	10,951	0	3,058	1.4	1.4	0.0
88	23,657	20,214	20,054	161	3,443	1.5	1.5	0.9
89	39,314	37,604	37,367	237	1,710	2.4	2.5	0.8
90	30,027	28,242	28,198	44	1,785	2.0	2.0	0.2
91	32,118	29,591	29,352	239	2,527	1.9	1.9	0.4
92	36,692	34,377	34,257	119	2,315	2.4	2.4	0.3
93	43,016	41,214	41,094	120	1,802	1.5	1.5	0.4
94	37,506	36,955	36,802	153	551	1.7	1.7	0.8
95	27,407	25,884	25,209	675	1,523	0.6	0.6	0.1
96	41,262	40,059	39,182	877	1,230	1.2	1.3	0.2
97	20,789	19,014	18,624	391	1,775	0.6	0.6	0.1
98	24,735	21,597	20,720	877	3,138	0.5	0.6	0.2
99	39,605	37,895	36,130	1,765	1,710	0.9	1.0	0.4
00	48,732	47,940	47,289	652	792	1.4	1.6	0.2
01	33,741	32,896	30,843	2,053	845	0.9	1.0	0.8
02	18,761	16,038	14,980	1,057	2,723	0.8	0.9	0.5
Average	28,627	26,868	26,989	451	2,053	1.5	1.6	0.4
Std. deviation	11,210	11,327	11,120	589	983	0.8	0.8	0.5

Year	<i>E.carbunculus</i> (average)	<i>E.carbunculus</i> (min)	<i>E. carbunculus</i> (max)	<i>L.kasmira</i> (average)	<i>L.kasmira</i> (min)	<i>L.kasmira</i> (max)	<i>P.auricilla</i> (average)	<i>P.auricilla</i> (min)	<i>P.auricilla</i> (max)
82	312	206	390	213	160	254	268	135	385
83	351	262	404	203	171	230	252	179	340
84	410	410	410	217	208	222	283	210	360
85	342	220	450	216	154	285	291	220	440
86	349	255	450	211	180	275	230	130	264
87	335	265	440	221	168	315	273	190	340
88	336	220	440	216	145	300	287	180	480
89	313	155	530	211	130	325	264	170	350
90	324	209	465	218	170	260	261	190	365
91	317	170	630	216	170	300	272	220	360
92	326	230	470	218	164	270	267	170	372
93	299	210	450	210	150	255	267	205	370
94	332	200	500	213	119	340	273	210	350
95	329	210	494	205	110	285	260	165	390
96	308	200	510	216	158	280	270	152	401
97									
98	342	217	411	204	122	300	285	200	430
99	314	222	405	204	93	375	267	190	350
00	432	264	1,000	183	120	260	264	150	416
01	328	207	818	197	127	290	270	190	481
02	322	100	710	183	120	230	253	100	370
Average	336	222	519	209	147	283	268	178	381
Std. deviation	32	59	157	11	28	38	14	32	51

Figure 10a. Groupers (*Epinephelus*, *Cephalopholis*, *Variola*): Harvest

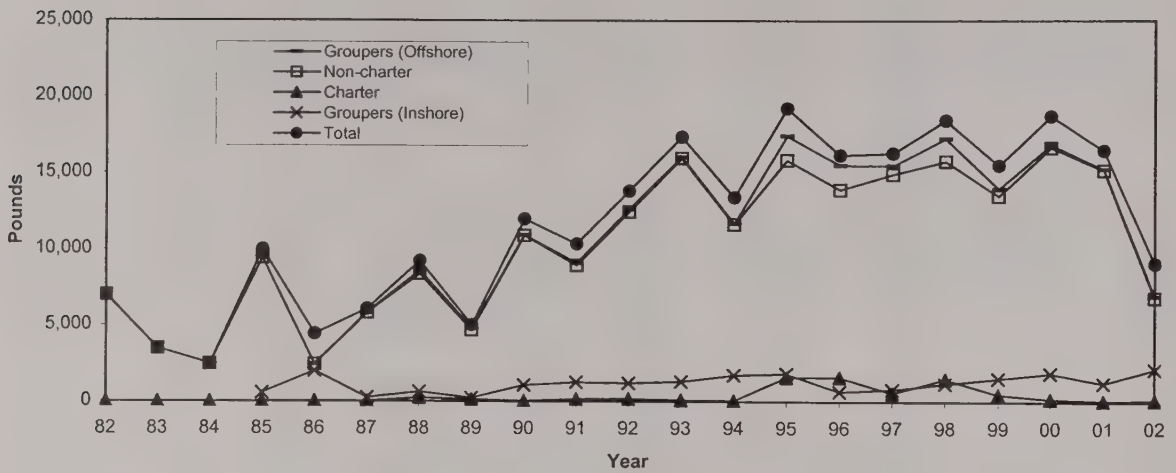


Figure 10b. Groupers (*Epinephelus*, *Cephalopholis*, *Variola*): CPUE

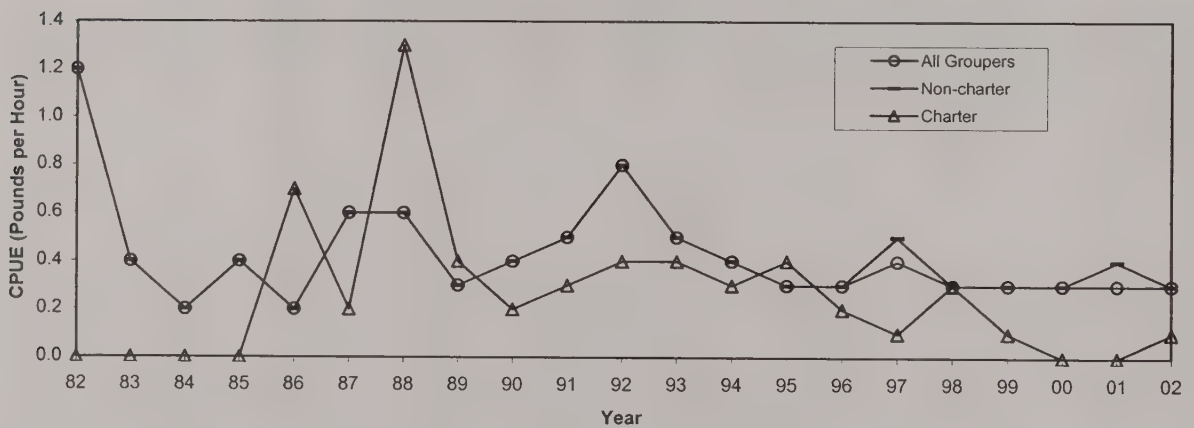


Figure 10c. Average Size Harvested: *Epinephelus fasciatus*

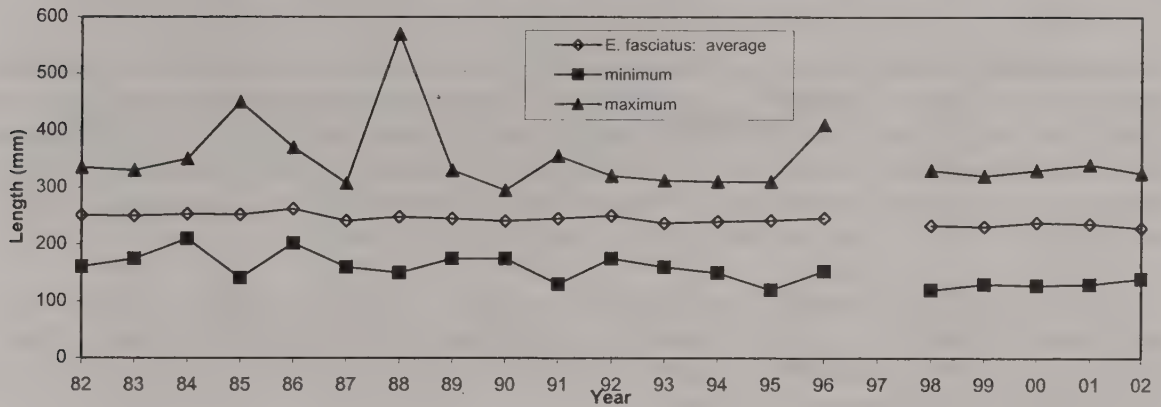


Figure 10d. Average Size Harvested: *Epinephelus merra*

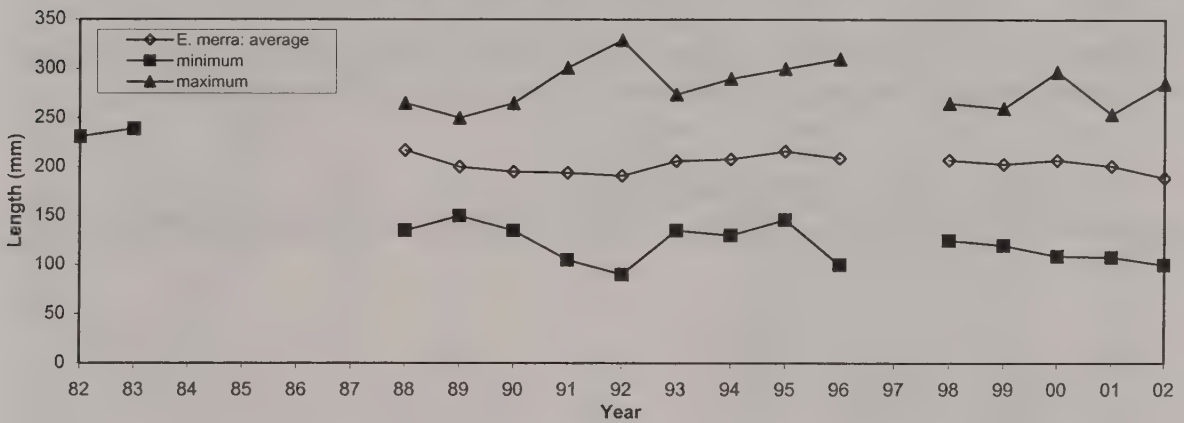
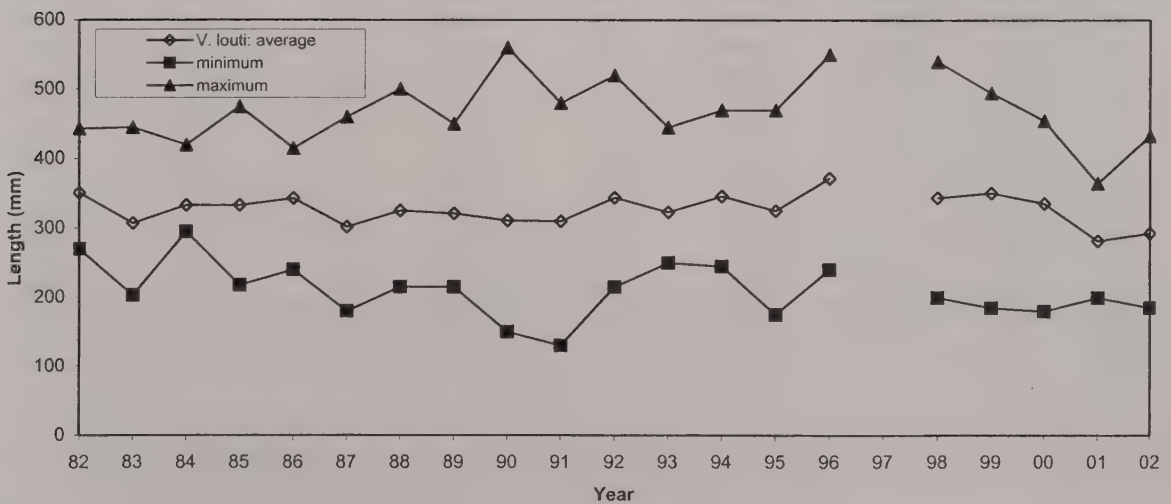


Figure 10e. Average Size Harvested: *Variola louti*



Interpretations: The total and non-charter harvest of groupers both decreased 45% and 55% respectively, while the charter harvest increased 53% in 2002. The CPUE for total harvest, non-charter, and charter fishing had no significant changes. CPUE for total groupers decreased from 0.3 to 0.4 lb/hr, CPUE for non-charter fishing remained the same, while CPUE for charters increased from virtually zero to 0.1 lb/hr. In recent years, the majority of large groupers observed in the field were harvested by spearfishing, rather than bottomfishing. Offshore fisheries made up 76% of the total grouper harvest.

The average sizes for the three selected grouper species appear to be relatively constant over the past 21 years, although there are year-to-year fluctuations. The spikes in the maximum sizes observed with *E. fasciatus* in 1985 and 1988 appear to be unusually large individuals (450 mm and 507 mm) since this species tends to have a terminal size around 300 mm.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of groupers landed by the total number of hours spent bottomfishing.

Year	Total Harvest	Offshore Harvest	Offshore Non-charter	Offshore Charter	Inshore Harvest	CPUE Offshore	CPUE Non-charter	CPUE Charter
82	7,000	7,000	7,000	0		1.2	1.2	0.0
83	3,471	3,471	3,471	0		0.4	0.4	0.0
84	2,463	2,463	2,463	0		0.2	0.2	0.0
85	9,972	9,410	9,410	0	562	0.4	0.4	0.0
86	4,425	2,442	2,425	17	1,983	0.2	0.2	0.7
87	6,066	5,823	5,814	9	243	0.6	0.6	0.2
88	9,215	8,594	8,359	236	621	0.6	0.6	1.3
89	5,016	4,795	4,668	127	221	0.3	0.3	0.4
90	11,965	10,907	10,879	28	1,058	0.4	0.4	0.2
91	10,332	9,076	8,918	158	1,256	0.5	0.5	0.3
92	13,812	12,609	12,435	175	1,203	0.8	0.8	0.4
93	17,343	16,037	15,939	97	1,306	0.5	0.5	0.4
94	13,403	11,677	11,620	57	1,726	0.4	0.4	0.3
95	19,226	17,411	15,826	1,585	1,815	0.3	0.3	0.4
96	16,153	15,500	13,906	1,594	653	0.3	0.3	0.2
97	16,286	15,480	14,906	573	806	0.4	0.5	0.1
98	18,438	17,252	15,759	1,493	1,186	0.3	0.3	0.3
99	15,499	13,969	13,484	484	1,530	0.3	0.3	0.1
00	18,721	16,846	16,663	183	1,875	0.3	0.3	0.0
01	16,485	15,252	15,177	75	1,233	0.4	0.4	0.0
02	9,070	6,925	6,810	115	2,145	0.3	0.4	0.1
Average	11,636	10,616	10,282	334	1,190	0.4	0.4	0.3
Std. deviation	5,437	5,097	4,790	534	586	0.2	0.2	0.3

Year	<i>E. fasciatus</i> (average)	<i>E. fasciatus</i> (min)	<i>E. fasciatus</i> (max)	<i>E. merra</i> (average)	<i>E. merra</i> (min)	<i>E. merra</i> (max)	<i>V. louti</i> (average)	<i>V. louti</i> (min)	<i>V. louti</i> (max)
82	251	161	335	231	231	231			
83	250	175	330	239	239	239			
84	253	210	350						
85	252	141	450				265	250	290
86	262	202	370				350	310	390
87	241	160	307				302	220	385
88	248	150	507	217	135	265	270	195	350
89	245	175	330	200	150	250	261	215	295
90	241	175	295	195	135	265	285	205	38-
91	245	130	355	194	105	301	270	250	320
92	250	175	320	191	90	329	284	235	310
93	237	160	312	206	135	274	346	29-	479
94	240	150	310	308	130	290	284	170	330
95	242	120	310	216	146	300	295	275	315
96	246	153	410	209	100	310	415	170	600
97									
98	233	120	330	207	125	265	263	180	340
99	231	130	320	203	120	260	288	179	430
00	238	128	330	207	109	297	241	190	300
01	236	130	340	201	108	254	310	239	440
02	229	140	325	189	100	285	299	185	411
Average	244	154	350	207	135	276	296	221	374
Std. deviation	8	26	63	14	43	27	42	42	81

Figure 11a. Emperors (*Lethrinus*, *Gnathodentex*, *Gymnocranius*, *Montaxis*): Harvest

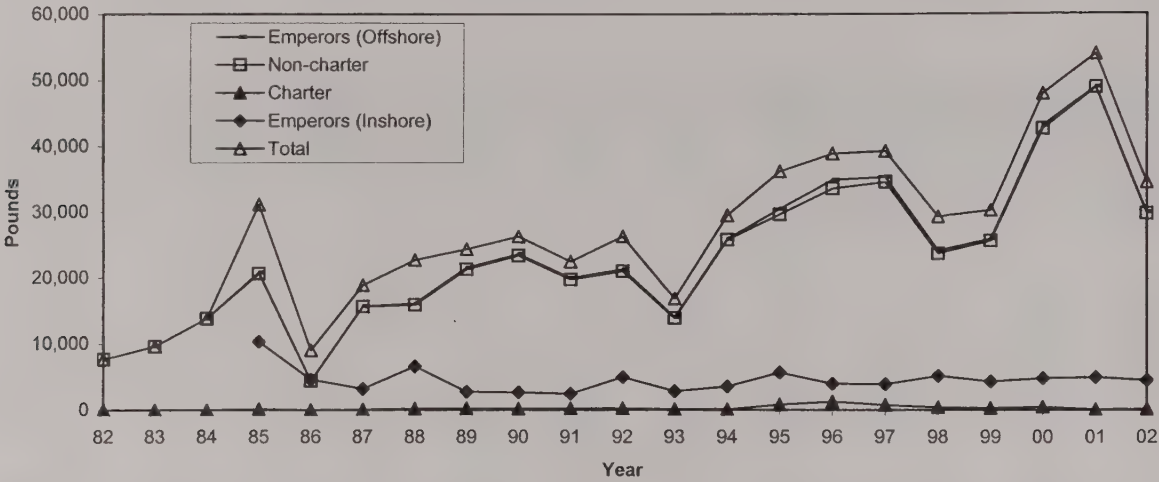


Figure 11b. Emperors (*Lethrinus*, *Gnathodentex*, *Gymnocranius*, *Monotaxis*): CPUE

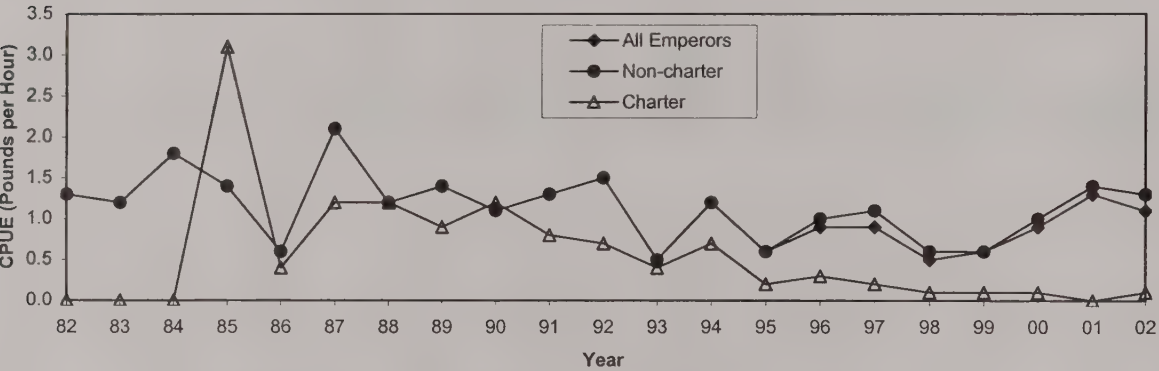


Figure 11c. Average Size Harvested: *Lethrinus olivaceus*

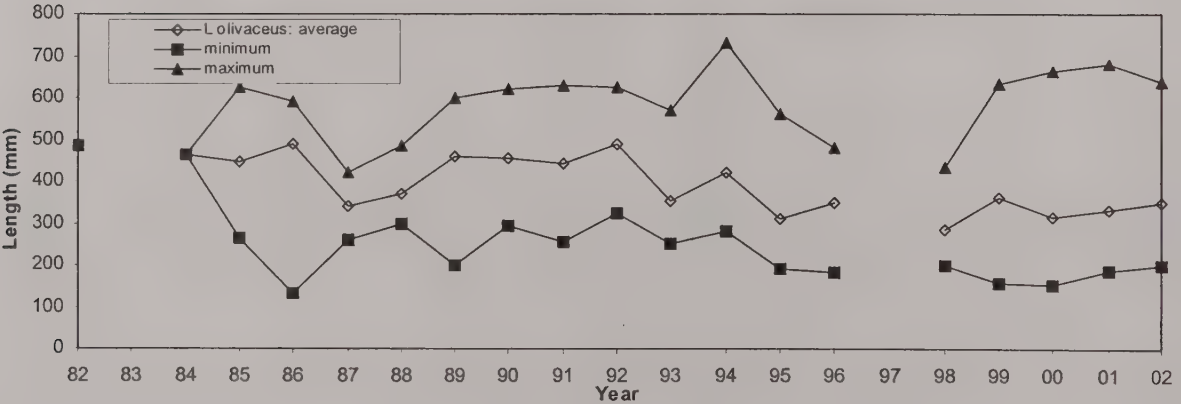


Figure 11d. Average Size Harvested: *Lethrinus obsoletus*

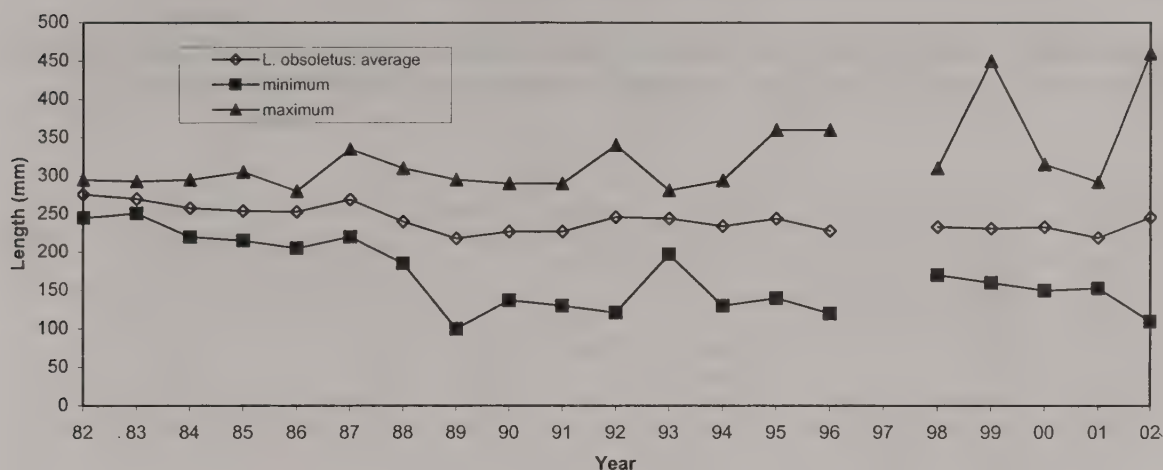
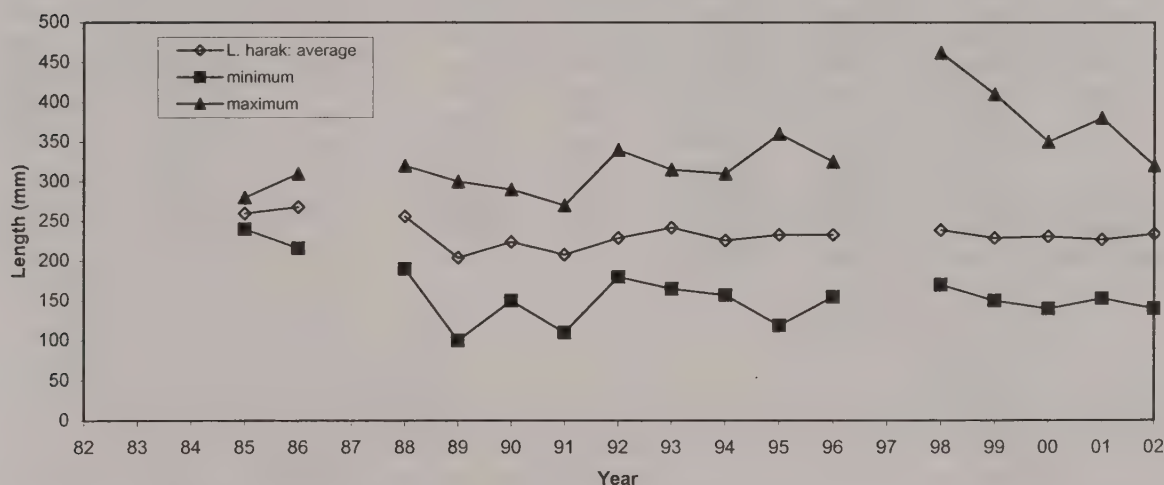


Figure 11e. Average Size Harvested: *Lethrinus harak*



Interpretations: The increased in the harvest of emperors in both the charter and non-charter sectors in 1995 and 1996 may have be due to the addition of the Agat Marina as an offshore sampling port. The CPUE for emperors, however, decreased 50% between 1994 and 1995.

The total and non-charter harvest of emperors decreased 36% and 39% in 2002, while charter harvest increased 56%. The CPUE for total and non-charter harvest of snappers also decreased, decreasing 15% and 7% respectively in 2002. Offshore fisheries made up 87% of the emperor harvest for 2002.

The average sizes for the two smaller species of emperors, *L. obsoletus* and *L. harak*, appear to be relatively constant for the past 21 years. The average size for *L. olivaceous* shows wider fluctuations due to it being the

longest emperor species on Guam, but has shown a general decrease in average size for the past 10 years.

Source: The DAWR creel survey data for the bottomfishing method.

Calculations: The yearly catch-per-unit-effort (CPUE) is calculated by using the year-end survey totals and dividing the total weight of bottomfish landed by the total number of hours spent bottomfishing.

Year	Total Harvest	Offshore Harvest	Offshore Non-charter	Offshore Charter	Inshore Harvest	CPUE Offshore	CPUE Non-charter	CPUE Charter
82	7,677	7,677	7,677	0		1.3	1.3	0.0
83	9,635	9,635	9,635	0		1.2	1.2	0.0
84	13,843	13,843	13,843	0		1.8	1.8	0.0
85	31,182	20,841	20,691	149	10,341	1.4	1.4	3.1
86	9,030	4,411	4,402	9	4,619	0.6	0.6	0.4
87	18,910	15,706	15,648	58	3,204	2.1	2.1	1.2
88	22,742	16,123	15,909	215	6,619	1.2	1.2	1.2
89	24,379	21,599	21,341	257	2,780	1.4	1.4	0.9
90	26,320	23,637	23,417	220	2,683	1.1	1.1	1.2
91	22,508	20,030	19,774	256	2,478	1.3	1.3	0.8
92	26,327	21,333	21,049	283	4,994	1.5	1.5	0.7
93	16,892	14,033	13,913	121	2,859	0.5	0.5	0.4
94	29,520	25,949	25,827	122	3,571	1.2	1.2	0.7
95	36,185	30,498	29,657	840	5,687	0.6	0.6	0.2
96	38,868	34,879	33,578	1,301	3,989	0.9	1.0	0.3
97	39,246	35,323	34,550	773	3,923	0.9	1.1	0.2
98	29,317	24,139	23,700	439	5,178	0.5	0.6	0.1
99	30,275	25,941	25,620	321	4,334	0.6	0.6	0.1
00	47,908	43,103	42,607	496	4,805	0.9	1.0	0.1
01	53,943	48,961	48,844	117	4,982	1.3	1.4	0.0
02	34,508	29,978	29,795	183	4,530	1.1	1.3	0.1
Average	27,105	23,221	22,927	293	4,532	1.1	1.1	0.6
Std. deviation	12,286	11,260	11,081	327	1,835	0.4	0.4	0.7

Year	<i>L. olivaceous</i> (average)	<i>L. olivaceous</i> (min)	<i>L. olivaceous</i> (max)	<i>L. obsoletus</i> (average)	<i>L. obsoletus</i> (min)	<i>L. obsoletus</i> (max)	<i>L. harak</i> (average)	<i>L. harak</i> (min)	<i>L. harak</i> (max)
82	485	485	485	276	245	295			
83				270	251	293			
84	462	462	462	258	220	295			
85	445	265	625	254	215	305	260	240	280
86	491	134	590	253	205	280	268	216	310
87	340	260	420	269	220	335			
88	370	300	483	240	185	310	256	190	320
89	460	200	600	218	100	295	204	100	300
90	454	295	620	227	137	290	224	150	290
91	443	255	630	227	130	290	208	110	270
92	490	325	625	246	121	340	229	180	340
93	353	250	570	244	197	281	242	165	315
94	420	280	731	234	130	294	226	157	310
95	312	190	560	244	140	360	233	119	360
96	348	185	480	228	120	360	233	155	325
97									
98	286	170	435	233	170	310	239	170	462
99	361	160	635	231	160	450	229	150	410
00	313	150	665	233	150	315	231	140	350
01	330	153	680	219	153	292	227	153	380
02	351	110	640	246	110	460	234	140	320
Average	396	168	576	243	168	323	234	158	334
Std. deviation	69	46	90	17	46	51	17	36	50

12a. 2002 Bottomfish Bycatch: Charter

Species	Released alive	Released dead/injured	Total # Released	Total Number Landed	% Bycatch
<i>Serranidae</i>	1		1	1	100.0
<i>E. fasciatus</i>	8		8	15	53.33
<i>Mullidae</i>	14		14	14	100.00
<i>P. multifasciatus</i>	46		46	55	83.64
<i>Siganus argenteus</i>	3		3	5	60.0
<i>Mugilidae</i>	1		1	1	100.0
<i>M. vidua</i>	9		9	9	100.00
<i>M. niger</i>	7		7	7	100.00
<i>O. niger</i>	5		5	8	62.50
Shallow bottomfish	10		10	40	25.00
TOTAL	145		145	194	74.74
Compared with All Species				237	61.18

12b. 2002 Bottomfish Bycatch: Non-Charter

Species	Released alive	Released dead/injured	Total Number Released	Total Number Landed	Percent Bycatch
<i>Carcharhinidae</i>					
<i>C. amblyrhynchos</i>	1		1	4	25.00
<i>C. melanopterus</i>	5		5	5	100.00
<i>Serranidae</i>	5		5	5	100.00
<i>C. urodeta</i>	4		4	24	16.67
<i>E. merra</i>	64		64	160	40.00
<i>Lutjanidae</i>					
<i>Variola louti</i>	1		1	21	4.76
<i>L. kasmira</i>	1		1	21	4.76
<i>Lethrinidae</i>	102		102	103	99.03
<i>L. harak</i>	5		5	132	3.79
<i>Labridae</i>	1		1	1	100.00
<i>Balistidae</i>	17		17	17	100.00
<i>R. aculeatus</i>	5		5	25	20.00
TOTAL	211	0	211	518	40.73
Compared with All Species				2,267	9.31

12c. Bottomfish Bycatch: Summary

Year	Released alive	Released dead/injured	Total Number Released	Total Number Landed	Percent Bycatch*	Interviews with Bycatch	Total Number of Interviews	Percent of Interviews with Bycatch
2001	620	3	623	1,855	33.6	58	183	31.7
2002	356	0	356	712	50.0	33	137	24.1

*"percent bycatch" is the percentage of a species of fish that was discarded compared to what was landed. Species that did not have bycatch are not included, only species that had bycatch.

Interpretation: Bycatch information was recorded beginning in 2000 as a requirement of the Bottomfish FMP. Historically, most fish that is landed by fishermen is kept, regardless of size and species. This may indicate a decrease of fish stocks of more desirable species, resulting in the harvest of juveniles and less desirable species.

Source: The DAWR creel survey data for bottomfishing method.

Calculations: Bycatch is obtained from the interviews with bottomfishing where bycatch was voluntarily reported. The numbers recorded are not expanded numbers, only from the bottomfish interviews obtained during 2002. Information obtained about bycatch includes the number of each individual fish species, an estimated length, and a computer generated calculated weight based on the estimated length. While most bycatch species are known by fishermen, characteristics of the fish are provided in an attempt to identify the fish to the species level.

Appendix 3

Hawaii

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Summary

None of the five BMUS species for which SPR values can be calculated have 2002 SPR values below the 20% critical threshold that defines recruitment overfishing under the FMP. Estimates range from a low of 26% for onaga to a high of 45% for uku when viewed on an archipelago-wide basis. Implementation of the state bottomfish management plan (which became law in June 1998) should bring an improvement to the locally depleted status of ehu and onaga in the MHI and thereby increase the archipelago-wide SPR estimates for these species.

The MHI bottomfish fishery, though showing signs of stress, has remained relatively stable over the last few years. Landings recorded to date for 2002 are lower than the 2001 landings (a 5.6% decrease). CPUE for the MHI was down (7.7%) in 2002 (179 lb/trip) from 2001 (194 lb/trip). Stocks of many of the BMUS species in this zone show clear signs of stress. Each of the BMUS species evaluated has a yellow light condition due to a drop in CPUE below 50% of original values. In addition, onaga and ehu stocks are severely depleted on a local basis as the MHI SPR values for these species are at or below 20% (5% and 20% for onaga and opakapaka, respectively). These SPR levels are below the critical threshold that would signify recruitment overfishing if present on a stock-wide basis and demand immediate action (state bottomfish management measures, when implemented, should meet this need). Hapuupuu SPR values calculated for the MHI are 26% for 2002 and SPR is 24% for both ehu and uku in the MHI.

Bottomfish resources in the NWHI remain relatively healthy. 2002 CPUE on a per trip basis increased 20.8% from 2001 in the Mau Zone and dropped 12.2% in the Hoomalu zone. On a per day basis CPUE values are up 54.8% in the Mau zone and down 24.1% in the Hoomalu. Analysis of SPR and percent immature in the catch show no localized depletion problems to date for any BMUS species in either zone.

Armorhead stocks outside of the US EEZ experienced a short pulse in recruitment in 1992 which did not carry over into 1993. The 1993 SPR values at Southeast Hancock Seamount are the highest recorded since 1986, but at 2.5%, they still indicate a collapsed fishery. Data for Hancock Seamount has not been available since 1994, but is available for areas outside of the US EEZ for years through 2002. SPR values obtained at Colahan Seamount have been shown to correlate well with values from Hancock Seamount and can be used as a proxy value. The 2002 SPR for Colahan Seamount was 0.2%, indicating a collapsed fishery.

**Historical Annual Statistics
Main Hawaiian Islands**

Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	810348	274	\$3,354	\$4.43	538	33
1987	783569	237	\$3,648	\$4.88	535	25
1988	1164492	329	\$4,828	\$4.36	572	37
1989	1006142	361	\$4,296	\$4.57	537	40
1990	645802	245	\$2,910	\$4.88	501	27
1991	547800	202	\$2,074	\$4.06	469	24
1992	587471	228	\$2,130	\$3.93	407	25
1993	347960	213	\$1,722	\$4.04	403	24
1994	457956	217	\$1,963	\$4.00	423	24
1995	439625	193	\$1,946	\$3.73	400	22
1996	439867	125	\$1,680	\$4.13	487	21
1997	512554	176	\$1,664	\$3.55	502	20
1998	478802	130	\$1,594	\$3.65	498	20
1999	455131	209	\$1,448	\$3.57	483	25
2000	496989	187	\$1,678	\$3.75	495	21
2001	366997	194	\$1,279	\$3.70	404	20
2002	361774	179	\$1,364	\$4.04	386	20
Ave.	582546	218	\$2,328	\$4.07	473	25
s.d.	232027	61	\$1,079	\$0.42	58	6

Historical Annual Statistics Mau Zone

Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	2206	NA	NA	NA	41
1987	NA	2889	NA	NA	NA	50
1988	NA	2136	NA	NA	4	37
1989	118000	4463	\$433,060	\$3.67	5	91
1990	249000	3435	\$816,720	\$3.28	14	77
1991	103000	1199	\$364,620	\$3.54	14	42
1992	71000	1273	\$242,820	\$3.42	8	38
1993	98000	1321	\$299,880	\$3.06	8	36
1994	160000	1573	\$524,800	\$3.28	12	68
1995	166000	1635	\$498,000	\$3.00	10	45
1996	135000	1543	\$440,100	\$3.26	13	53
1997	105000	1976	\$375,900	\$3.58	9	61
1998	66000	1689	\$192,060	\$2.91	7	42
1999	54000	1808	\$178,740	\$3.31	7	51
2000	49000	1053	\$169,540	\$3.46	6	42
2001	50000	916	\$141,000	\$2.82	6	36
2002	108000	1416	\$334,800	\$3.10	5	45
Ave.	109429	1914	\$358,003	\$3.26	9	50
s.d.	55315	920	\$181,880	\$0.26	3	16

**Historical Annual Statistics
Hoomalu Zone**

Year	Total Landings (lbs)	CPUE (lbs/trip)	Inflation Adjusted Revenue	Price per Pound	Number of Vessels	SPR Average
1986	NA	5301	NA	NA	NA	75
1987	NA	8187	NA	NA	NA	113
1988	NA	4702	NA	NA	12	66
1989	184000	5481	\$616,400	\$3.35	5	70
1990	173000	5403	\$563,980	\$3.26	5	64
1991	283000	5871	\$894,280	\$3.16	4	82
1992	353000	9464	\$1,193,140	\$3.38	5	98
1993	287000	8412	\$961,450	\$3.35	4	109
1994	283000	6903	\$973,520	\$3.44	5	64
1995	202000	6130	\$636,300	\$3.15	5	73
1996	176000	6216	\$607,200	\$3.45	3	78
1997	241000	6351	\$785,660	\$3.26	6	65
1998	266000	5315	\$819,280	\$3.08	7	66
1999	269000	5611	\$968,400	\$3.60	6	62
2000	213000	5909	\$813,660	\$3.82	5	62
2001	236000	5757	\$750,480	\$3.18	5	64
2002	120000	4638	\$423,600	\$3.53	4	59
Ave.	234714	6215	\$786,239	\$3.36	5	75
s.d.	60836	1327	\$204,490	\$0.20	2	17

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Introduction

The commercial bottomfish stocks in the Hawaiian Islands are divided into two fisheries: seamount groundfish and deep-slope bottomfish. The seamount fishery targets alfonso, *Beryx* spp., and armorhead, *Pseudopentaceros wheeleri*. The only area in the US EEZ for this fishery is Southeast Hancock Seamount located 1,400 nm northwest of Honolulu. This trawl fishery was started by the Russians and Japanese in the late 1960s and large catches were made for about 10 years until they caused a crash in the fishery. This fishery has never been domestically harvested. A moratorium on fishing within the US EEZ began in 1986 and continues through the present as no substantial recovery in the fishery has been observed.

The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. The deep-slope fishing grounds within the US EEZ are divided into three management zones. The inhabited main Hawaiian Islands (MHI) support numerous subsistence, recreational, and commercial fishermen with considerable overlap by category. The uninhabited Northwestern Hawaiian Islands (NWHI) are divided into the Mau Zone, closer to the MHI, and the Hoomalu Zone. Fishing in these zones is conducted solely by commercial fishermen and requires federal licensing for such activities. The Hoomalu Zone is a limited entry zone with 7 vessels participating in 1998; 7 vessels fished the Mau Zone in the same year.

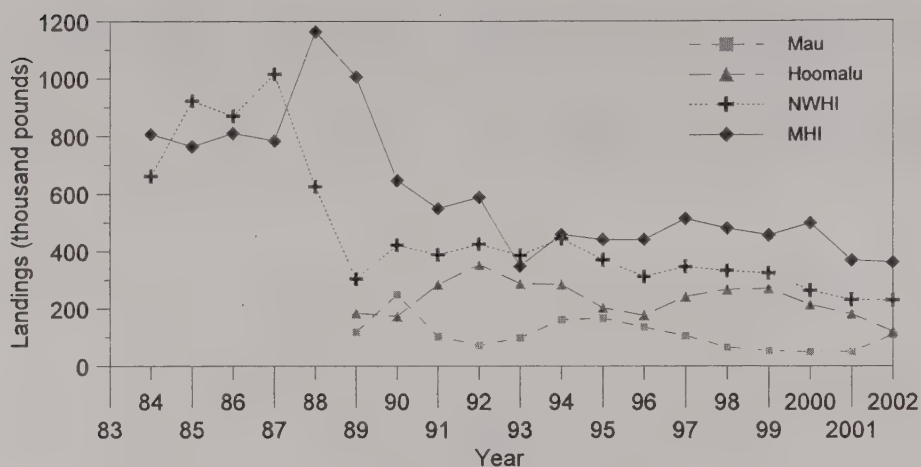
Vessel size varies considerably with larger fully commercial vessels (30 ft in length and over) conducting trips of about 10 days, and smaller vessels (<30 ft) generally restricted to the MHI and trips of 1-3 days. Most vessels in this fishery are fully outfitted with electronic navigation and fish-finding equipment, as well as with electric or hydraulic line-hauling equipment. The catch is sold fresh in the round for local consumption.

Catch and revenue data for bottomfish have been collected by the State of Hawaii Division of Aquatic Resources (HDAR) since 1948 in the form of a report submitted by commercial fishermen. No data is collected for recreational or subsistence fishermen, but their catch is estimated to be about equal to the commercial catch in the MHI. Data obtained from a market monitoring program and data from fishermen interviews are combined with the HDAR data set for most of the analysis presented in this report.

Recommendations

- 1) The BPT recommends the Council support and participate in the State of Hawaii's effort to review and assess effectiveness of the Main Hawaiian Island bottomfish area closures.
- 2) The BPT recommends that the NMFS re-evaluate MSY and standardized cpue and effort estimates for the Hawaiian archipelago.

Figure 1. Hawaii's BMUS landings from the NWHI and MHI



Year	Mau	Hoomalu	Total NWHI	MHI ²
1984	NA	NA	661	807
1985	NA	NA	922	763
1986	NA	NA	869	810
1987	NA	NA	1015	783
1988	NA	NA	625	1164
1989	118	184	303	1006
1990	249	173	421	646
1991 ¹	103	283	387	548
1992 ¹	71	353	424	587
1993 ¹	98	287	385	348
1994 ¹	160	283	443	458
1995 ¹	166	202	369	440
1996 ¹	133	176	309	440
1997 ¹	105	241	346	513
1998 ¹	66	266	332	479
1999 ²	54	269	323	455
2000	49	213	262	497
2001	50	236	286	367
2002³	108	120	228	361
mean	109.29	234.71	468.95	603.79
s.d.	55.25	60.84	235.24	227.89

¹ NWHI data from combination NMFS and HDAR

² Data from HDAR

³ MHI data not complete.

Source: Data are from HDAR. Data are only those from BMUS. Landings and values presented represent fishes that were sold. Pelagic and miscellaneous species data were not included.

Calculation & Adjustment: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet.

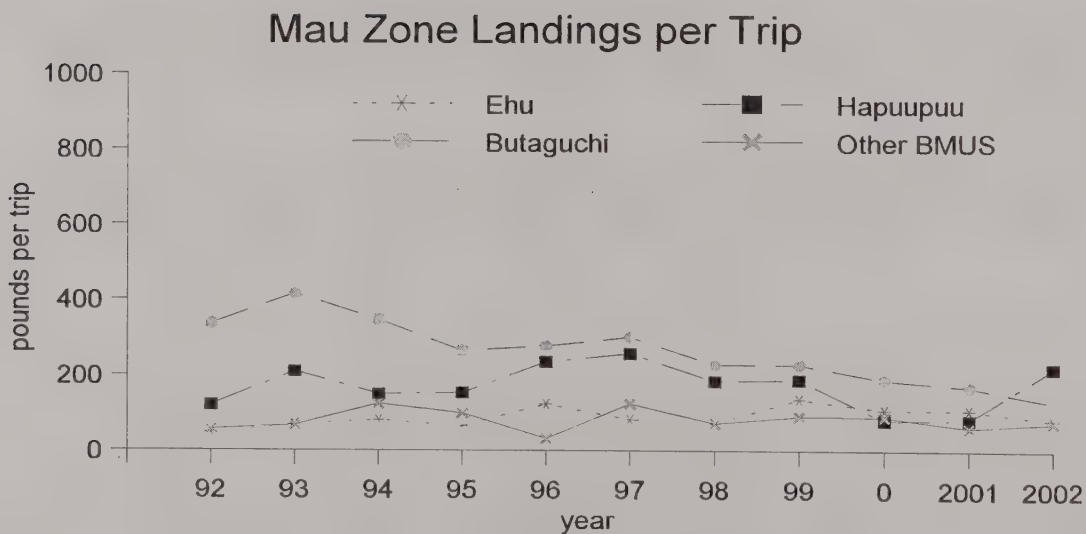
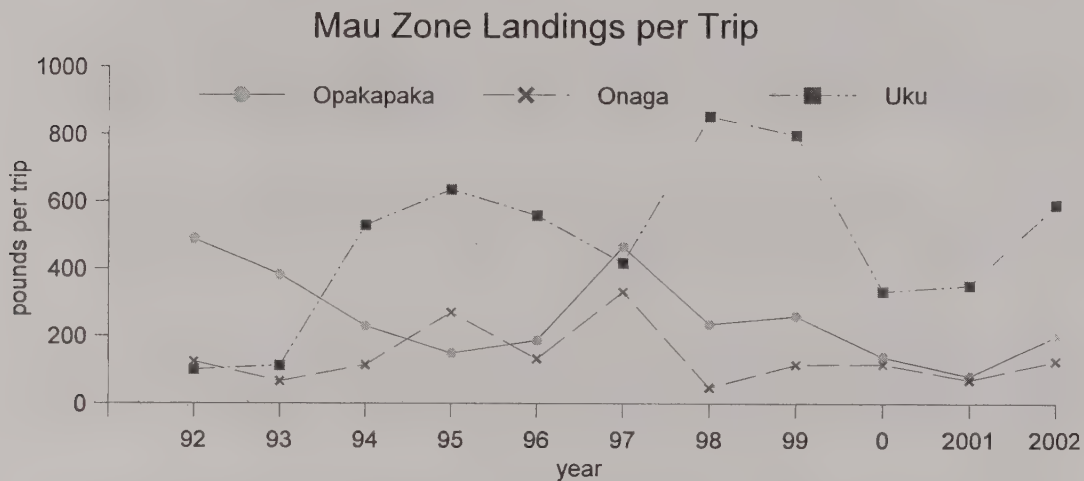
Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips that resulted in BMUS being caught were included. Trolling only trips to the NWHI that were not targeting BMUS are not included.

Comments & Interpretation: The ex-vessel sales of BMUS in 2002 clearly show the substantial effects of a change in fishing strategy or to participation (or lack of participation) in the fishery. The overall vessel sales reports indicate that the total NWHI BMUS landings were substantially lower in 2002. A single vessel dropped out of each management zone with varying effects on the overall zone landings (fig. 5).

Although the Mau zone lost a vessel there were some vessels that did increase their targeting of bottomfish which ran counter to their usual pelagic species/mixed species targeting strategy. The BMUS landings in the Mau zone increased by 116% while the number of trips increased by 21(38%).

The Hoomalu zone lost a single participating vessel and the effects of that loss of a highliner was realized in the BMUS landings dropping by 49% while the number of trips fell by 15(36%).

Figure 2a. Northwestern Hawaiian Islands Mau Zone BMUS species composition of landings per trip, by weight.



NWHI BMUS average pounds sold per trip by species, Mau Zone

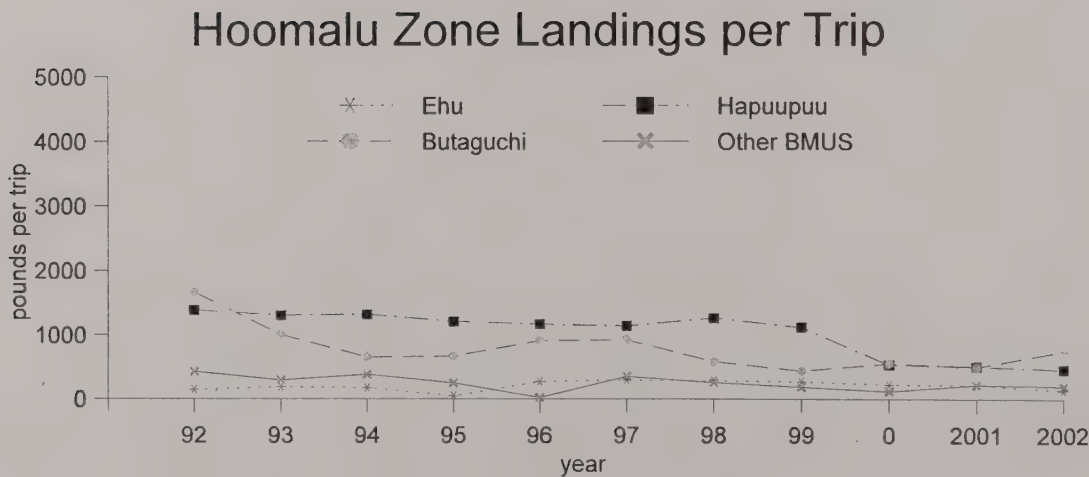
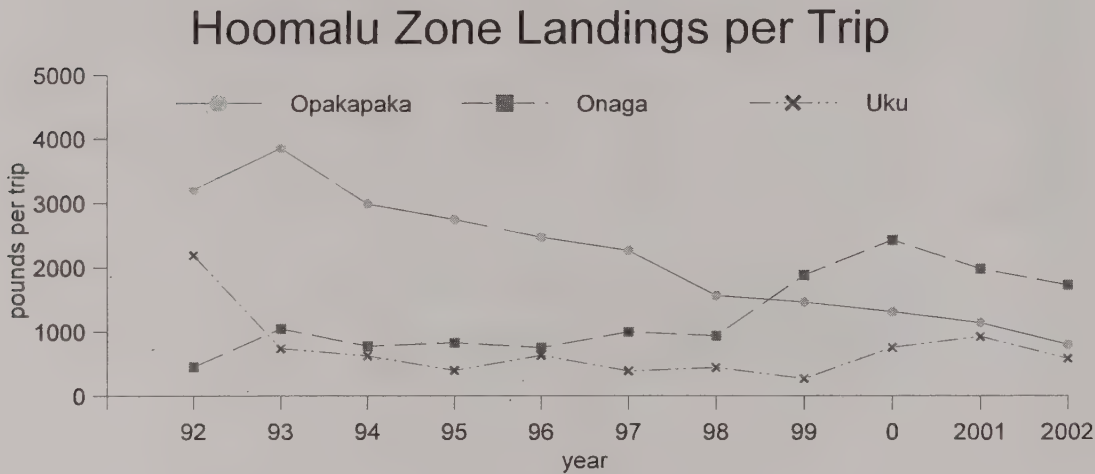
Species	1992 ¹	1993 ¹	1994 ¹	1995 ¹	1996 ²	1997 ²	1998 ²	1999 ²	2000 ²	2001 ^{2,3}	2002 ²
Opakapaka	488	382	229	149	187	465	235	259	138	80	199
Onaga	124	66	114	270	132	331	47	115	116	70	126
Ehu	48	69	81	65	123	82	72	136	108	109	81
Uku	100	112	529	635	558	417	852	796	333	343	588
Hapuupuu	121	210	150	153	235	257	184	187	81	81	219
Butaguchi	336	415	346	264	276	300	227	227	187	171	128
Other BMUS	56	67	124	99	32	124	72	91	90	62	75
Total per trip	1273	1321	1573	1635	1543	1976	1689	1811	1053	916	1416

¹ Data from combination of NMFS and HDAR data sets.

² Data from HDAR data set.

³ 2001 data are a combination of HDAR data sets.

Figure 2b. Northwestern Hawaiian Islands Hoomalu Zone BMUS species composition of landings per trip, by weight.



NWHI BMUS average pounds sold per trip by species, Hoomalu Zone

Species	1992 ¹	1993 ¹	1994 ¹	1995 ¹	1996 ²	1997 ²	1998 ²	1999 ²	2000 ²	2001 ^{2,3}	2002 ^{2,4}
Opakapaka	3208	3849	2984	2741	2426	2258	1556	1454	1304	1530	793
Onaga	450	1042	771	825	752	993	931	1872	2417	1680	1716
Ehu	148	185	172	47	272	298	285	273	225	187	139
Uku	2187	736	623	397	632	387	438	266	750	970	578
Hapuupuu	1386	1305	1318	1206	1166	1141	1266	1119	535	645	463
Butaguchi	1660	1004	655	665	909	923	583	439	556	549	750
Other BMUS	425	291	380	249	21	351	256	188	122	196	199
Total per trip	9464	8412	6903	6130	6216	6351	5315	5611	5909	5757	4638

¹ Data from combination of NMFS and HDAR data sets.

² Data from HDAR data set.

³ 2001 data are a combination of HDAR data sets.

⁴ Preliminary data for 2002 are nearly complete.

Source: The data are from HDAR. Data are only those from BMUS. Landings presented represent fishes that were sold. Pelagic species data were not included.

Calculation & Adjustment: The BMUS data were totaled by zone and divided by the number of trips to each zone. The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

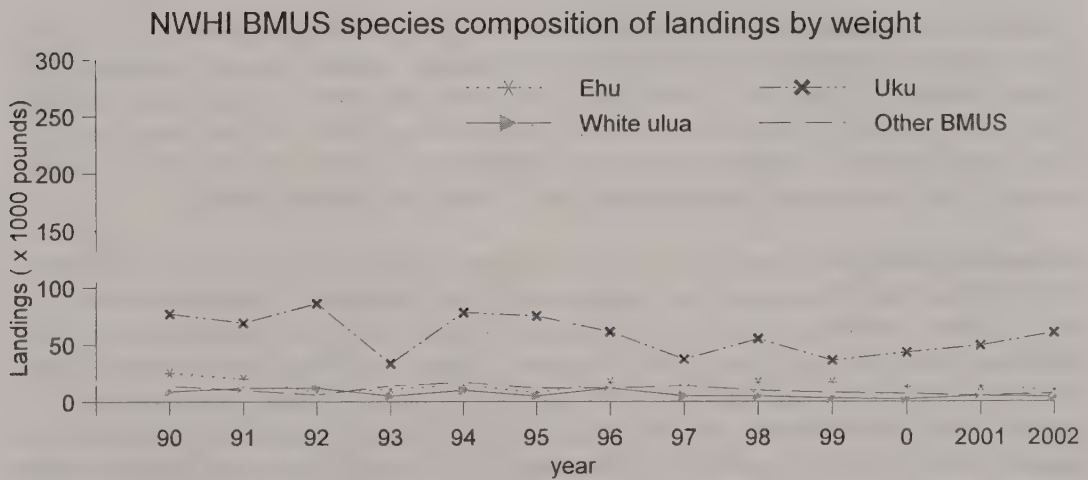
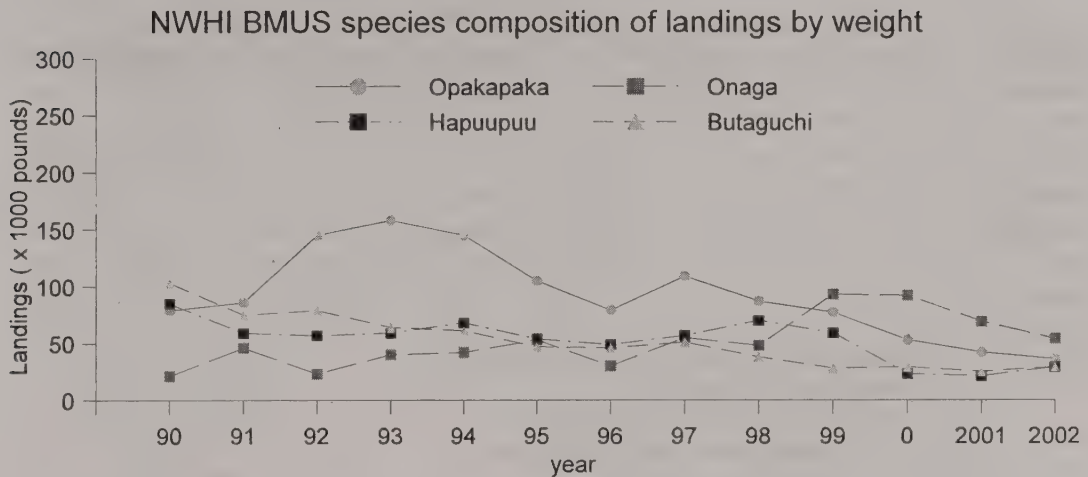
Comments & Interpretations: The Mau zone average landing per trip has increased by 54% over last year. One vessel quit the fishery in 2002. Average pounds per trip of BMUS species has added 500 pounds per trip over last year. Most of the major BMUS landings increased substantially. Only ehu and butaguchi landings categories decreased. Trip lengths varied by vessel and trip strategy/target. Most of the trips incorporated some trolling activity.

In looking at the Mau zone data table the per trip catches of onaga and opakapaka have risen in 2002. This was mainly due to a more concerted effort to target and catch bottomfish this year by a few of the Mau zone participants. Normally the multipurpose vessels based on Kauai focus on pelagics for most of the year. Bottomfish are usually targeted during the winter season when they are more abundant. The Oahu component of the fleet is more focused on full time bottomfishing. They divide their time between bottomfishing the Mau zone and the MHI.

The Hoomalu zone BMUS landing per trip in 2002 fell 19%. The Hoomalu zone fleet size was reduced by 1 vessel in 2002. The reduction in effort and associated landings of a single vessel

in this fishery which had only 5 participants has had a large impact on overall landings (figure 1). Up until 2002 the Hoomalu zone fleet had very stable participation and landings for the last 7-8 years.

Figure 3. NWHI BMUS species composition of landings by weight



Data table for Figure 3 (in thousands of pounds)

Species	1990	1991 ¹	1992 ¹	1993 ¹	1994 ¹	1995 ¹	1996 ²	1997 ²	1998 ²	1999 ²	2000 ²	2001 ^{2,3}	2002 ^{2,4}
Opakapaka	79	86	145	158	145	105	79	109	87	77	53	67	36
Onaga	21	46	23	40	42	53	30	55	48	93	92	73	54
Ehu	25	20	8	11	15	8	17	15	17	17	13	14	10
Hapuupuu	85	59	57	59	68	54	49	57	70	59	23	31	29
Butaguchi	103	75	79	64	61	47	46	51	38	28	29	32	29
Uku	77	69	86	33	78	75	62	37	55	36	43	59	60
White ulua	9	12	12	5	10	5	13	5	5	3	2	6	4
Other BMUS	14	10	6	14	17	12	12	14	10	8	7	6	7

¹ Data from a combination of NMFS and HDAR data.

² Data from HDAR data set.

³ 2001 data are a combination of HDAR data sets.

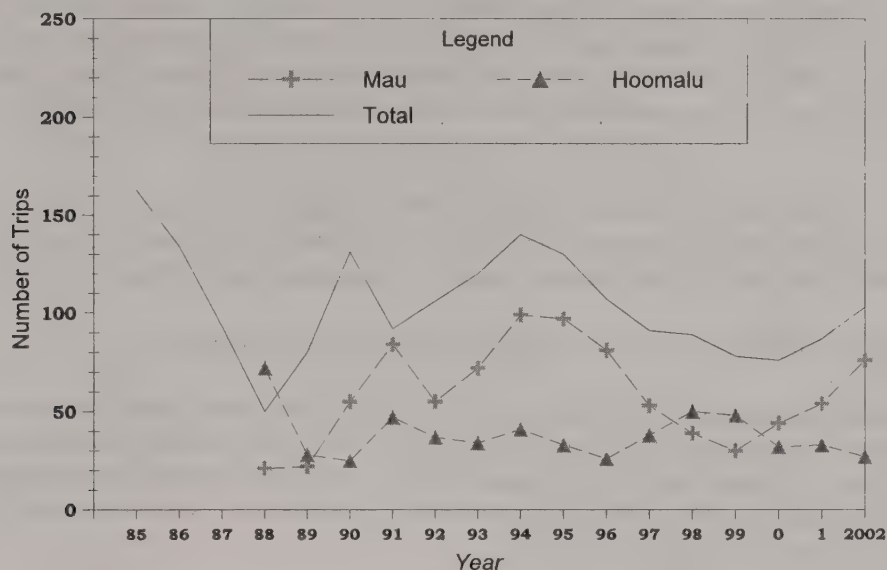
⁴ Preliminary data for 2002 are nearly complete.

Source: Data for 1996-2002 is from the HDAR integrated data set. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program. Data from 1987-1990 are expanded NMFS estimates. Landings presented represent fishes that were sold.

Calculation & Adjustment: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Comments & Interpretation: Overall BMUS landings are down for 2002. Most of the landings of BMUS decreased. Opakapaka landings showed the largest decline. Of the major species only uku, hapuupuu, and butaguchi had landings similar to those of last year. It is interesting to note that although the landings for some BMUS species remained stable in the context of the whole fishery the source of the landings has flip flopped with the normally strong Hoomalu zone landings, which were down this year due to the loss of a highliner vessel, being replaced by the increase in the Mau zone participation and strategy which resulted in increased BMUS landings from their zone.

Figure 4. Number of trips made by NWHI bottomfish fleet, Mau and Hoomalu Zones



Year	Trips		
	Mau	Hoomalu	Total
1985	NA	NA	160
1986	NA	NA	163
1987	NA	NA	134
1988	21	72	93
1989	22	28	50
1990	55	25	80
1991 ¹	84	47	131
1992 ¹	55	37	92
1993 ¹	72	34	106
1994 ¹	99	41	140
1995 ¹	97	33	130
1996 ²	81	26	107
1997 ²	53	38	91
1998 ²	39	50	89
1999 ²	30	48	78
2000 ²	47	36	83
2001 ^{2,3}	55	41	87
2002 ^{2,4}	76	26	102
mean	59.07	38.80	106.44
s.d.	25.20	12.23	30.37

¹ Based on combined NMFS and HDAR data.

² Based on HDAR data.

³ 2001 data are a combination of HDAR data sets.

⁴ Preliminary data for 2002 are nearly complete.

Source: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

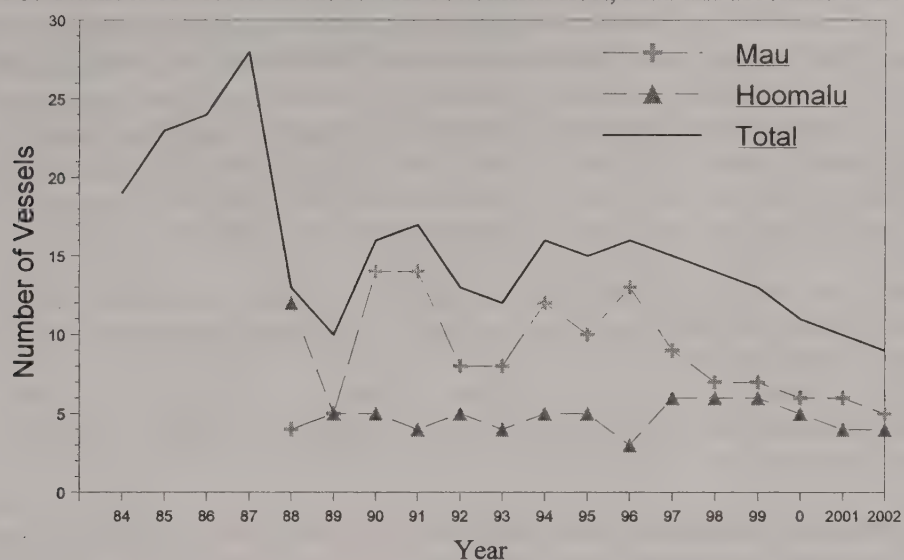
Data for 1996-2000 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1986-1990 are NMFS estimates. The trips were totaled by management area fished.

Calculation & Adjustment: Trips were counted from the HDAR integrated data set.

Comments & Interpretation: Trip numbers fluctuated this year after 1 vessel from each zone left the fishery. There was a 38% increase(21 trips) in Mau zone trips despite losing a vessel that had participated on a part-time level. One vessel limited itself to the 5 minimum required trips to maintain its permit. The Mau zone trip count varies as each operator makes the fishing strategy decision that suits their operation.

The loss of a vessel in the Hoomalu zone resulted in a 36% decrease(15 trips) in trips. All of the vessels in the Hoomalu zone made less trips than in 2001. Only one vessel made the minimum number of trips to maintain its permit. There were also non-fishing factors involved in the decision by some vessel owners to cut back on the number of bottomfishing trips to the NWHI(boat maintenance and family commitments).

Figure 5. Number of vessels in the NWHI bottomfish fleet, Mau and Hoomalu Zones



Year	Boats		Total ²
	Mau	Hoomalu	
1984	NA	NA	19
1985	NA	NA	23
1986	NA	NA	24
1987	NA	NA	28
1988	4	12	13
1989	5	5	10
1990	14	5	16
1991 ¹	14	4	17
1992 ¹	8	5	13
1993 ¹	8	4	12
1994 ¹	12	5	16
1995 ¹	10	5	15
1996 ³	13	3	16
1997 ³	9	6	15
1998 ²	7	6	13
1999 ³	7	6	13
2000 ³	6	5	11
2001 ³	6	5	11
2002 ^{3,4}	5	4	9
mean	8.53	5.33	15.47
s.d.	3.36	2.02	5.00

¹ Based on a combination NMFS and HDAR data set.

² Total may not match sum of areas due to vessel participation in multiple areas.

³ Based on HDAR data.

⁴ Preliminary data for 2002 are nearly complete.

Source: The 2002 data set are complete as of March 2004. The data are from the HDAR integrated data set which provides the most complete data set dealing with the effort and landings of the NWHI fishing fleet. Data in this report are only from those trips that were directed at bottomfish species or in which bottomfish gear was used (zero catch trips or efforts were included). Trolling only trips to the NWHI that were not targeting BMUS are not included. Trolling only trips that resulted in BMUS being caught were included.

Data for 1996-2000 was from HDAR. Data for 1991-1995 are from a combination of HDAR and NMFS market monitoring program and the HDAR fast-track data system. Data from 1984-1990 are NMFS estimates.

Calculation & Adjustment: The number of active participating vessels were totaled by year and management zone.

Comments & Interpretation: There was a loss of 2 vessels in the overall NWHI fleet. One vessel from each zone dropped out of the fishery. The number of active vessels during the previous 2 years had been identical. The Hoomalu zone has lost a highliner type vessel while the Mau zone has lost a part-time vessel.

Table 1. Mau Zone Bycatch by Species, 2002

R = # released, S = # sold, % bycatch within species= $\{R/(R+S)\} * 100$

% bycatch within species groups=(R/R+S by species group)*100

% bycatch per total catch=(R/total R+S)*100

Pelagic MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Shark (unidentified)	57	0	100 %	55	100 %
Tiger shark (G. cuvieri)	3	0	100 %	1	100 %
Bottomfish MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Ehu (E. carbunculus)	2	2070	<1 %	8	< 1 %
Hapuupuu(E. quernus)	12	1254	1%	0	0 %
Butaguchi (P. dentex)	184	641	22 %	10	1 %
Black Ulua (C. lugubris)	2	81	2 %	0	0 %
Kahala (Seriola spp.)	226	0	100 %	653	100 %
Miscellaneous species	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Omilu (C. melampygus)	20	193	9 %	30	38 %
Barracuda	1	9	10 %	0	0 %

Table 2. Hoomalu Zone Bycatch by Species, 2002

R = # released, S = # sold, % bycatch within species= $\{R/(R+S)\} \times 100$

% bycatch within species groups= $(R/R+S \text{ by species group}) \times 100$

% bycatch per total catch= $(R/\text{total } R+S) \times 100$

Pelagic MUS	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Shark (unidentified)	8	0	100 %	34	100 %
Tiger shark (<i>G. cuvieri</i>)	4	0	100 %	3	100 %
 Bottomfish MUS					
	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Opakapaka (<i>P. filamentosus</i>)	1	2206	<1 %	1	<1 %
Kalekale (<i>P. sieboldii</i>)	439	474	48 %	264	24 %
Butaguchi (<i>P. dentex</i>)	303	1248	20 %	767	32 %
White Ulua (<i>C. ignobilis</i>)	221	128	63 %	532	70 %
Kahala (<i>Seriola</i> spp.)	1610	0	100 %	3360	100 %
 Miscellaneous species					
	# released 2002	total # sold 2002	% bycatch by species 2002	# released 2001	% bycatch by species 2001
Omilu (<i>C. melampygus</i>)	43	0	100 %	41	82 %

Source: The 2002 bycatch data were from HDAR's integrated data set which combines the NWHI daily logs and the sales report. The bycatch data are recorded on the daily logs and are filled in on a daily basis by the fishermen while at sea. The species that are listed here are only those that were identified on the daily logs that were released therefore it is not a complete list of all species caught or sold.

Calculation & Adjustment: The bycatch percentage was calculated by dividing the number of released fish by the sum of the number of sold fish plus the number of released. The number of sold fish does not equal the total catch but does represent a verifiable number of fishes taken. The numbers of fish that are retained but not sold, ie. eaten or given away, is believed to be very few compared to the total number sold. The release category does not specify whether the fish was released alive or released dead.

The data consists of the reported releases from all of the daily log sheets for NWHI fishing trips

that were submitted. All fishing trips (including main Hawaiian island areas or other areas) made by the permitted fishing vessels are reported to the State under this reporting system. Only the information on trips made to the NWHI which landed bottomfish management unit species, regardless of gear type or fishing method, were included in the data set. Nearly 100% of the NWHI fishing trips were accounted for by the HDAR reporting system. There were no adjustments made for data from any missing or unreported trips.

Comments & Interpretation: The identification of the species and number of fishes that were released indicates that the majority of the released fish would fall into the category of economic or regulatory discards. Since the State of Hawaii instituted regulations to control the practice of shark finning by requiring that the entire carcass be brought to shore along with the fins the NWHI bottomfishermen have been releasing all of the sharks that they have caught. Previous to the implementation of the new shark carcass retention regulation a small percentage of the sharks were retained by a few vessels due to the high value of their fins. Although the value of the shark fins are high the income generated could not offset the costs of lost and damaged equipment and the loss of catch that can be directly attributed to sharks. The percentage of live verses dead releases under the present regulations are not known. Sharks constitute the major regulatory discard for this fishery.

The economic discards are mainly constituted of species which have low or in some cases no commercial value. Bottomfish management unit species as well as pelagic management unit species and miscellaneous other species are released. Releases are generally prompted by product shelf-life concerns(due to trip length), low value, or concern for future resources(release of small fish). The fishermen are making an effort to minimize some economic liability by live releasing "low value" fish early in the trip and retaining them later during the trip to obtain the maximum value.

Conservation or stock related releases are another component of the release strategy employed by the fishermen. The NWHI fishermen have been live releasing a low number of small sized high value BMUS species such as onaga, opakapaka, ehu, and uku. Large numbers of various commercially low valued species(ie., butaguchi, kalekale, and white ulua) are also released live in an effort to reduce/minimize any waste of fishery resources.

Releases of fishes by management area presents patterns that reflect the fishermen's strategy for maximizing their profits. In the Mau zone where the trip lengths and distances to markets are short and hold space is not a limiting factor most of the fish caught are retained for sale regardless of their short shelf-life or low-value. The Hoomalu zone presents more of a challenge to the fishermen to try to maximize their profitability on these long trips. The maximizing of hold space and the ice capacity make this a tricky balancing act. Hold space is primarily reserved for high valued species. The shelf-life concerns for various species are addressed by releasing the species early on in the trip and retaining them during the latter stages of the trip to maximize the returns on the fresher product. This strategy lessens waste(by live releases) and maximizes economic profits(fresher product) while conserving the limited bottomfish resources. Additionally the fresher appearance of the fish put up for sale usually increases the price paid and

enhances the reputation of the fisherman as being quality conscious and bringing in a top quality product.

The largest component of the releases is that of kahala, *Seriola* spp. The kahala was once a very important commercial species but due to the presence of ciguatoxin in a percentage of fish it has not been sold for many years due to liability concerns. It is thought that since kahala are caught in such large numbers while fishing for the targeted species their population represent competition for food and habitat resources. The large kahala are also known to feed on the valuable bottomfish species, often stealing them off the hooks and thus contributing to the inefficiencies of the fishing operations as well. The fishermen release the majority of kahala that they catch although they may from time to time use them as bait or chum. The releases can be either live or dead depending on the preference of the captain. The percentage of live releases to dead releases are not known. With the start of the NWHI bottomfish observer program in 2003/04 information on the discard rates and disposition of the discards will be collected.

Many of the NWHI captains voluntarily participate in the State of Hawaii's ulua tagging study and routinely tag many kahala and other jacks. Recent recapture results from the tagging study showed a kahala that was tagged on the SW side of St. Rogatien Bank in 2000 was recaptured in 2004 on "The Grounds" off of Keahole Point, Kailua-Kona on the island of Hawaii. The kahala had traveled at least 678 "straight line" miles and grew approximately 4 inches while at liberty for 3 years and 7 months.

Figure 6. MHI species composition of landings by weight

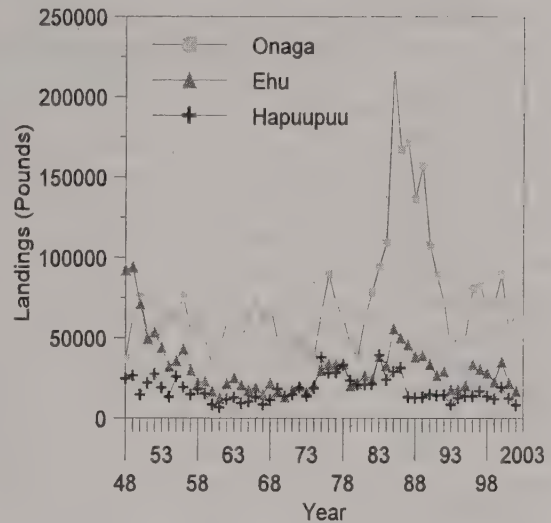
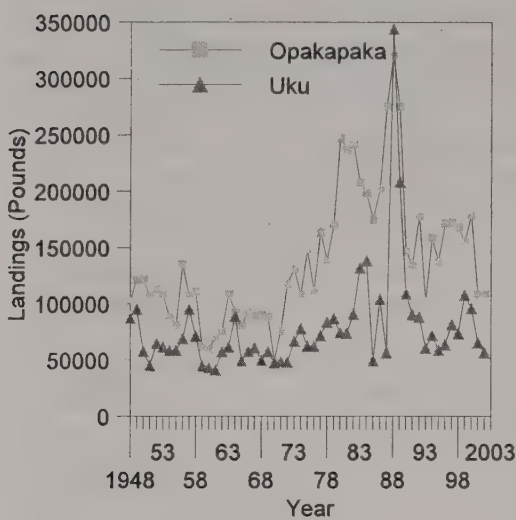


Figure 8

Interpretation: Most species show declining trends from the mid- and late-eighties to 1993 then peaking in the late 90's and falling to current lower levels. The prevailing interannual pattern in landings is episodic versus predictably periodic or constant. 2002 landings for all species are preliminary as they are based on catch reports submitted to date. Data from earlier years is essentially complete. Landings for all species were highest in the mid 1980's. Landings of ehu and hapuupuu are well below the long-term average, approximating lows of the early 1960's.

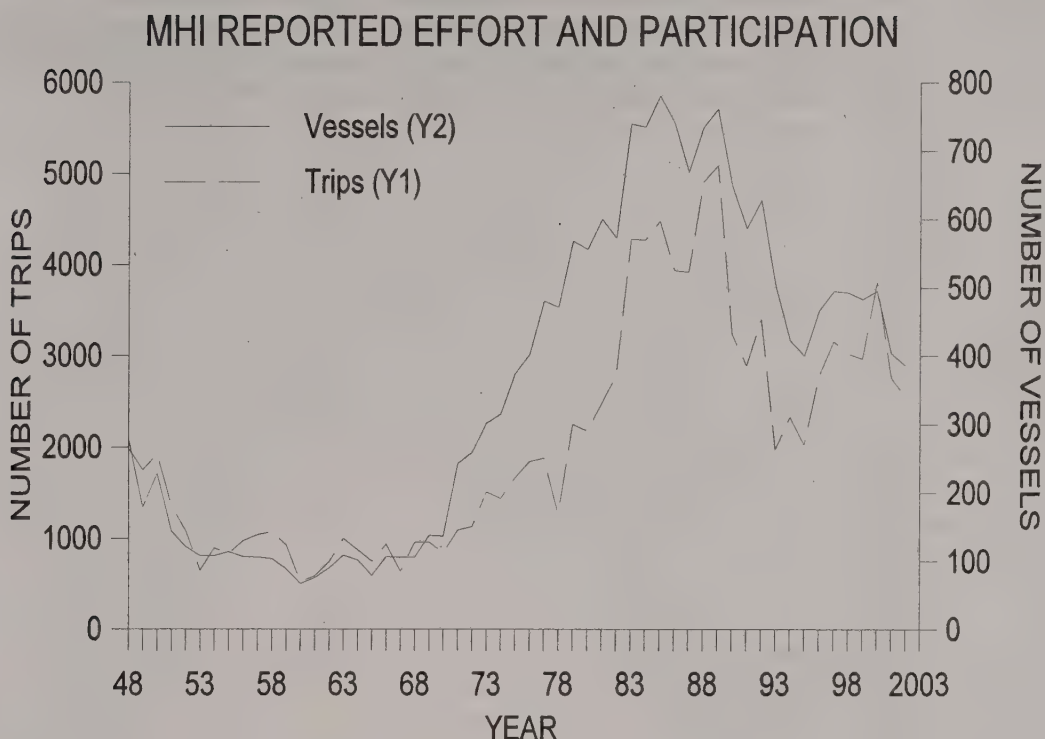
Source: Total commercial landings by species are from HDAR commercial catch report data for the MHI with no screening by gear. 2001 values have been updated from last year's report with an essentially complete data set for that year. 2002 values are preliminary estimates of annual landings based on landings reported to date and should increase for all species by an unknown amount with further reporting.

Comments: Landings presented here are commercial reported landings only and do not include any expansion for recreational landings.

MHI Landings by Species

YEAR	OPA	ONA	EHU	UKU	HAP	1977	163813	71747	33689	71915	28540
1948	102651	36804	92323	87235	24609	1978	138931	62208	34333	83798	33271
1949	121243	62979	94097	95273	26397	1979	170180	46271	20339	87128	23538
1950	121664	75398	71286	57814	14514	1980	247378	37489	21712	74782	20962
1951	106423	53018	49699	45065	22000	1981	237254	62351	26900	73921	21178
1952	112917	44604	53716	64799	27499	1982	241977	78372	24542	90793	21263
1953	108504	56506	44200	61619	19009	1983	207345	94082	38793	131860	39447
1954	88641	67583	32278	58767	13367	1984	198260	109046	33022	138313	24019
1955	80516	63208	36017	58564	25849	1985	174746	218552	56039	49264	29055
1956	134980	75986	43313	69108	19224	1986	202467	167112	50259	104047	31626
1957	106656	53988	30157	95267	14782	1987	274929	171416	46018	56753	13232
1958	111131	63774	22309	71321	18033	1988	320601	136641	38547	344128	12838
1959	62043	49745	23107	44705	15294	1989	275167	156952	39393	208171	12954
1960	59405	33158	16950	43186	8418	1990	146861	107514	33848	108840	14934
1961	70083	42701	12370	41134	6642	1991	134326	88978	26902	90272	14216
1962	75492	59788	21742	57568	11663	1992	178014	71715	29461	88474	14454
1963	108505	53225	25267	61601	12865	1993	102514	43141	17981	60910	8593
1964	93618	47325	20914	89156	9321	1994	158276	51502	18000	72133	12712
1965	81039	65040	17605	49485	10297	1995	137473	48948	20689	59036	13819
1966	92815	69634	19342	57849	13277	1996	171428	80953	33925	63792	13723
1967	89364	64022	14899	60970	8480	1997	172308	82874	30778	81367	16984
1968	89908	69922	21984	49677	11287	1998	167918	69077	28417	73724	13610
1969	88621	48454	16483	57542	18300	1999	155300	71749	23009	107826	12080
1970	49655	37894	13364	47443	13651	2000	179172	89431	35368	96012	19420
1971	76388	47250	17626	48710	14746	2001	108089	54232	22160	65634	12431
1972	117367	49213	20347	48077	18994	2002	107681	67489	17204	56549	8244
1973	130785	39811	16336	66875	13878	mean	138544	72096	31528	78736	17905
1974	107828	38883	21015	77939	18874	s.d.	59437	36650	17103	46059	7612
1975	147755	66029	30155	62117	38140						
1976	111520	89518	33788	62165	28214						

Figure 7. MHI reported effort and participation



Interpretation: Preliminary 2002 values for effort and participation are based on reports received to date and not expanded for any late reporting. Participation indicated to date suggest a sharp decline in participation and effort from 2000. These values are apt to increase with more complete reporting, but are not apt to reach 2000 levels.

Landings and CPUE for bottomfish trips are tabulated in the following table. These figures differ from those presented in Figure 1 (landings) and Figure 14 (CPUE). Those presented here are screened for bottomfish trips only (as defined below). In Figure 1 landings are for bottomfish species caught on all gears without screening criteria and in Figure 14 data are further screened by area fished and landings of individual fishers to reflect the effective fishing effort required to “standardize” CPUE. Landings and CPUE for 2002 are above the 2001 values even though the data set is preliminary with late reports still outstanding. The values are, however, below the long-term average, and the CPUE value is the third lowest on record.

Source: HDAR commercial catch report data.

Calculation & Adjustment: MHI commercial bottomfish trip and vessel values are obtained

from the HDAR commercial fisher's report data. Participation (# of vessels) is presented as the number of unique license numbers reporting bottomfishing trips for a particular year. For 1948-1993 the reported value for participation is based on the State fiscal year (July-June). For 1994-1999 the participation is reported on a calendar year basis. Trips qualify as bottomfish trips if they use bottomfish handline gear and at least 90% of the catch is of BMUS species.

Yr	#Ves	#Trip	Tot.Lbs	Lbs/Trip
48	207	1987	323858	162.99
49	196	1751	338406	193.26
50	164	1924	302137	157.04
51	126	1355	282271	208.32
52	110	1091	232235	212.86
53	106	650	123867	190.56
54	103	894	233557	261.25
55	108	836	197757	236.55
56	106	975	257183	263.78
57	102	1041	239485	230.05
58	96	1075	238138	221.52
59	76	929	213322	229.63
60	69	527	148339	281.48
61	65	586	171768	293.12
62	98	742	219203	295.42
63	110	1001	290690	290.40
64	87	876	297039	339.09
65	85	750	237624	316.83
66	97	940	274293	291.80
67	99	641	236588	369.09
68	116	959	252305	263.09
69	130	964	232754	241.45
70	219	841	169792	201.89
71	198	1093	173001	158.28
72	185	1135	194967	171.78
73	238	1511	246341	163.03
74	241	1442	218750	151.70
75	295	1664	322986	194.10
76	306	1845	301071	163.18
77	377	1881	323991	172.24

Yr	#Ves	#Trip	Tot.Lbs	Lbs/Trip
78	414	1268	272620	215.00
79	423	2251	316132	140.44
80	461	2181	372369	170.73
81	430	2481	392205	158.08
82	526	2790	432259	154.93
83	541	4283	484603	113.15
84	558	4272	428608	100.33
85	583	4481	476457	106.33
86	538	3939	476745	121.03
87	535	3920	475313	121.25
88	572	4911	687379	139.97
89	537	5091	634691	124.67
90	501	3242	338401	104.38
91	469	2895	285046	98.46
92	407	3401	329024	96.74
93	403	1977	199023	100.67
94	423	2333	226436	97.06
95	400	2031	194828	95.93
96	466	2780	253887	91.33
97	495	3158	288107	91.23
98	493	3023	268607	88.85
99	483	2970	261148	87.92
2000	495	3810	310817	81.58
2001	404	2761	215575	78.08
2002	386	2556	221359	86.60
mean	299	2049	293370	178.01
s.d.	179	1246	111293	76.16

Figure 8a. Hawaii bottomfish landings, revenues, inflation-adjusted revenues, 1970-present.

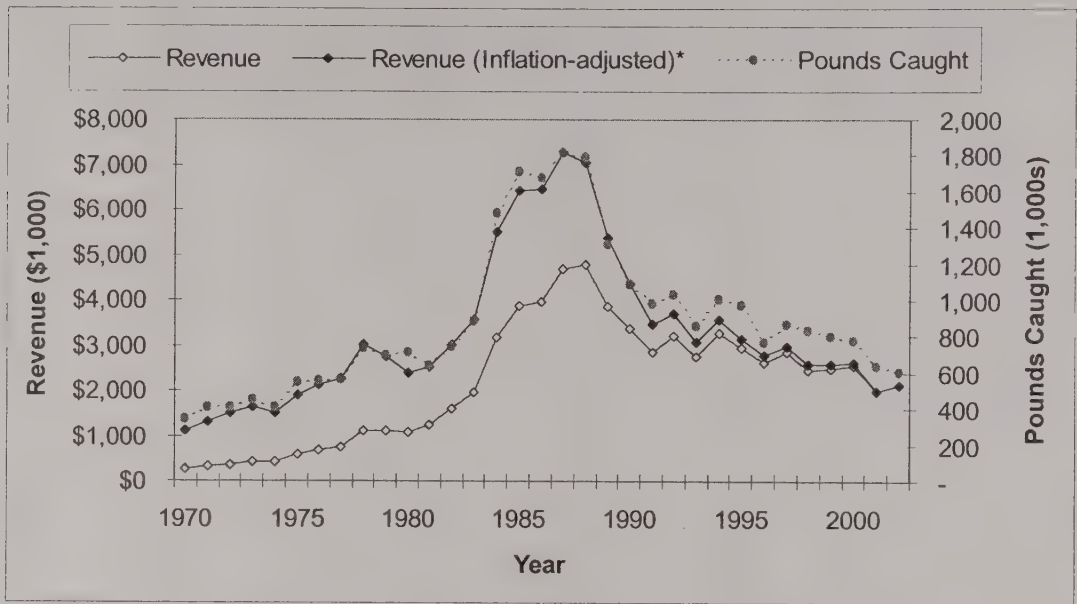
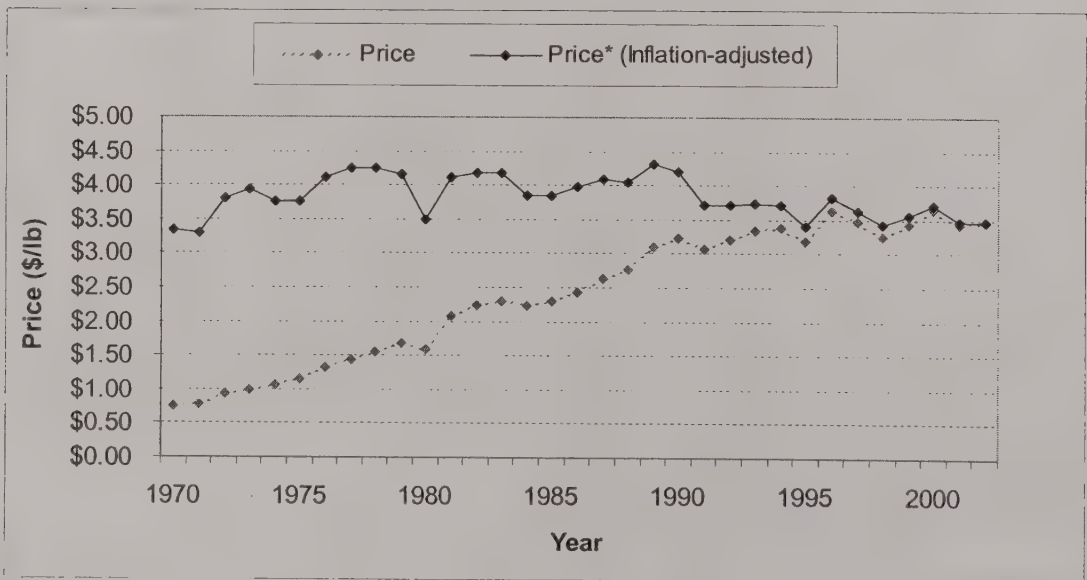


Figure 8b. Hawaii bottomfish price and inflation-adjusted price, 1970-present



Interpretation: After twenty years of growth, Hawaii bottomfish landings and *real* (inflation-adjusted) revenue peaked in 1987 and then declined by 67% and 70%, respectively, in the fifteen years since then. Much of this decline was caused by reductions in fishing participation (vessels and trips) due to limited entry and to a weak market for fresh bottomfish in the 1990s.

In 2002, landings continued to decline. However, the revenue increased due to the fish price increased by 3 cents from the previous year.

There is a slightly declining trend from 1991 to 2001 for inflation-adjusted ex-vessel bottomfish prices. Based on its movement, the price trend can be divided into three periods, 1970-1976, 1977-1990, and 1991-2002. Bottomfish price (inflation-adjusted) increased substantially during 1970-1976, from \$3.33 to \$4.11 per pound. It stabilized around \$4.00 during the period of 1977-1990 (except a drop in 1985), then declined gradually from \$4.21 per pound in 1990 to \$3.47 in 2002. Previous economic research (mid-1980s) showed a strong inverse relationship between monthly and weekly price and landings, but this relationship appears weaker in the 1990s, perhaps due to increased imports of bottomfish from Pacific island nations. The supply-demand relationship in the Hawaii bottomfish market will be discussed later in the report.

Of particular importance in interpreting bottomfish price trends, which strongly influence the economic performance of bottomfish vessels, is the increasing presence of imported bottomfish (snappers) in the Hawaii market. According to U.S. Customs data for the Port of Honolulu, 715,000 pounds of snapper were imported in CY 2002 worth \$1.92 million (\$2.68 per pound). This amounts exceeded domestic supply and thus was a significant factor in ex-vessel prices. Tonga and Australia were the largest sources of fresh snapper, with Fiji and New Zealand also being major sources.

Data: "Landings" refer to Pounds Caught (vs. Pounds Sold). Revenue is ex-vessel.

Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83 although there may be problems of under-reporting during the latter part of that period¹. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984 - 1990. Data from 1991 - 1997 use a combination of HDAR figures and NMFS adjustments, while data for 1998 - 2001 are solely from HDAR data. For 2002, data from HDAR reports are used for NWHI for the entry year, but

¹ The likelihood of that under-reporting is shown by the "jump" in NWHI landings when the Western Pacific Regional Fishery Management Council (and subsequently in 1987 NMFS) shoreside monitoring program began in 1984, with 38,000 pounds reported landed by the State in 1983 and 661,000 pounds reported landed by the Council in 1984. NWHI reported NWHI landings to HDAR in 1984 were 224,000 pounds.

for MHI only from January to September, due to the form changes in HDAR catch reports. HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

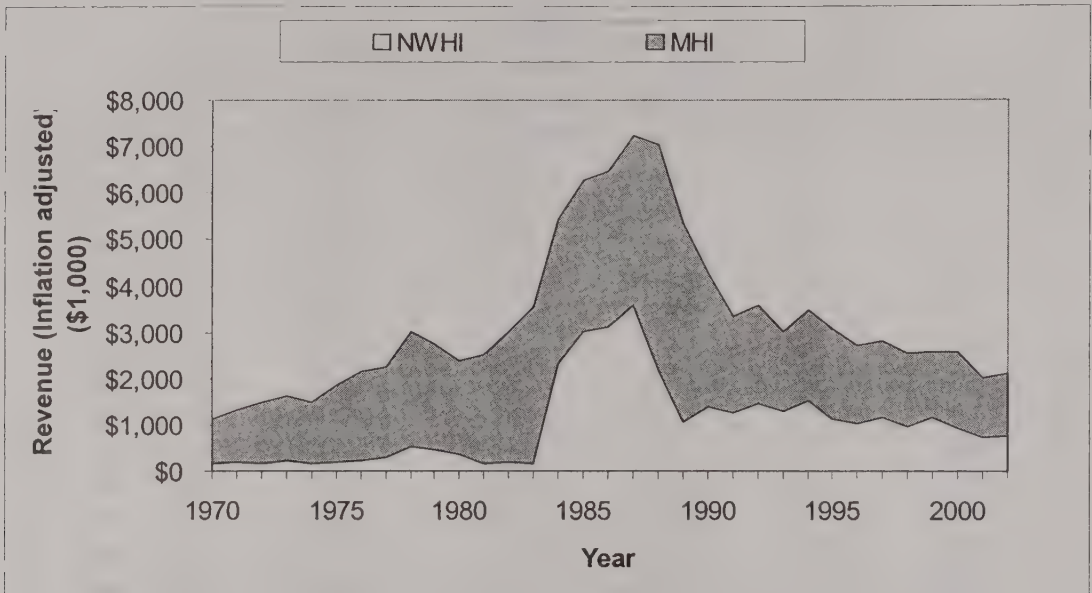
Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI), 1983-84 baseline; prices* are adjusted for inflation to the current year.

Data source: Data imported from b8702xnb.xls (3/12/04)

Hawaii bottomfish landings, revenue, and price, 1970 - present. (* Inflation-adjusted.)

	Pounds Caught All Areas (1,000s)	Revenue All Areas (\$1,000)	Revenue* (Inflation- adjusted)	Price ² Per Pound Sold	Price * (Inflation- adjusted)	HCPI
1970	344	\$253	\$1,115	\$0.76	\$3.33	40.9
1971	410	\$312	\$1,321	\$0.78	\$3.31	42.6
1972	407	\$366	\$1,500	\$0.93	\$3.81	44.0
1973	454	\$418	\$1,642	\$1.00	\$3.93	45.9
1974	413	\$421	\$1,494	\$1.06	\$3.77	50.8
1975	549	\$584	\$1,897	\$1.16	\$3.77	55.5
1976	558	\$693	\$2,143	\$1.33	\$4.10	58.3
1977	562	\$764	\$2,251	\$1.44	\$4.23	61.2
1978	740	\$1,100	\$3,010	\$1.55	\$4.24	65.9
1979	698	\$1,123	\$2,766	\$1.69	\$4.17	73.2
1980	713	\$1,082	\$2,382	\$1.59	\$3.51	81.9
1981	643	\$1,262	\$2,514	\$2.07	\$4.12	90.5
1982	750	\$1,600	\$3,005	\$2.23	\$4.19	96.0
1983	887	\$1,976	\$3,570	\$2.31	\$4.18	99.8
1984	1,481	\$3,192	\$5,518	\$2.23	\$3.85	104.3
1985	1,717	\$3,853	\$6,438	\$2.31	\$3.85	107.9
1986	1,682	\$3,958	\$6,470	\$2.43	\$3.97	110.3
1987	1,819	\$4,687	\$7,291	\$2.63	\$4.09	115.9
1988	1,794	\$4,796	\$7,042	\$2.76	\$4.06	122.8
1989	1,314	\$3,867	\$5,376	\$3.10	\$4.31	129.7
1990	1,094	\$3,371	\$4,376	\$3.24	\$4.21	138.9
1991	984	\$2,864	\$3,468	\$3.07	\$3.72	148.9
1992	1,043	\$3,199	\$3,700	\$3.21	\$3.71	155.9
1993	862	\$2,749	\$3,084	\$3.33	\$3.74	160.7
1994	1,011	\$3,277	\$3,587	\$3.39	\$3.71	164.7
1995	972	\$2,949	\$3,157	\$3.19	\$3.42	168.4
1996	768	\$2,636	\$2,779	\$3.62	\$3.82	171.0
1997	872	\$2,855	\$2,989	\$3.47	\$3.63	172.2
1998	834	\$2,470	\$2,595	\$3.26	\$3.43	171.6
1999	801	\$2,496	\$2,595	\$3.43	\$3.57	173.4
2000	781	\$2,550	\$2,608	\$3.64	\$3.72	176.3
2001p	643	\$1,993	\$2,014	\$3.44	\$3.48	178.4
2002p	607	\$2,124	\$2,124	\$3.47	\$3.47	180.3
Average	885	\$2,177	\$3,267	\$2.40	\$3.83	113.9
Standard Deviation	407	\$1,316	\$1,649	\$0.95	\$0.29	48.3

Figure 9. Hawaii bottomfish landings, and revenue* by area (NWHI vs. MHI), 1970 - 2002.
(*Inflation adjusted)



Interpretation*: The variation of Hawaii bottomfish revenue (inflation-adjusted) over time mainly resulted from the changes of the NWHI bottomfish revenue. NWHI bottomfish revenue grew dramatically in the mid-1980s, due to the increase of landings in the same period, and then tailed off. Inflation-adjusted revenue in 2002 is only 20% that in 1987 (the peak).

Inflation-adjusted revenue from main Hawaiian Islands bottomfish grew steadily through the 1970s and 1980s as both *real* prices and total landings increased substantially. Beginning in 1988, total landings began to decline, falling almost 60% in the subsequent decade.

Revenue from MHI was always greater than the revenue from NWHI. Before mid-1980s, MHI bottomfish revenue made up over 80% of the total Hawaii bottomfish revenue. The proportion declined due to a dramatic increase of NWHI bottomfish landings in the mid-1980s, and the MHI revenue was about 50% of the total during the period of 1985 to 1987. Since then, revenues of both areas declined, but revenue from MHI was still at a level above the NWHI, at 64% of the total in 2002.

These changes in total landings are related to both catch rates and participation. More interpretation can be gleaned from discussion in detailed tables and figures in this report.

Data: Hawaii Division of Aquatic Resources (HDAR) commercial catch reports are used for all the main Hawaiian Islands (MHI) landings and revenue; HDAR reports are also used for Northwestern Hawaiian Islands (NWHI) landings from 1970-83. NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings from 1997 to 2001. For 2002, data from HDAR reports are used for NWHI for the entry year, but for MHI only from January to September, due to the form changes in HDAR catch reports. HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

Revenue* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI); revenue* and prices* are adjusted to the current year.

Data source: Data imported from b8702xnb.xls (3/12/04)

NWHI bottomfish landings, revenue, and price by source, 1970 - present.
 (* Inflation-adjusted.)

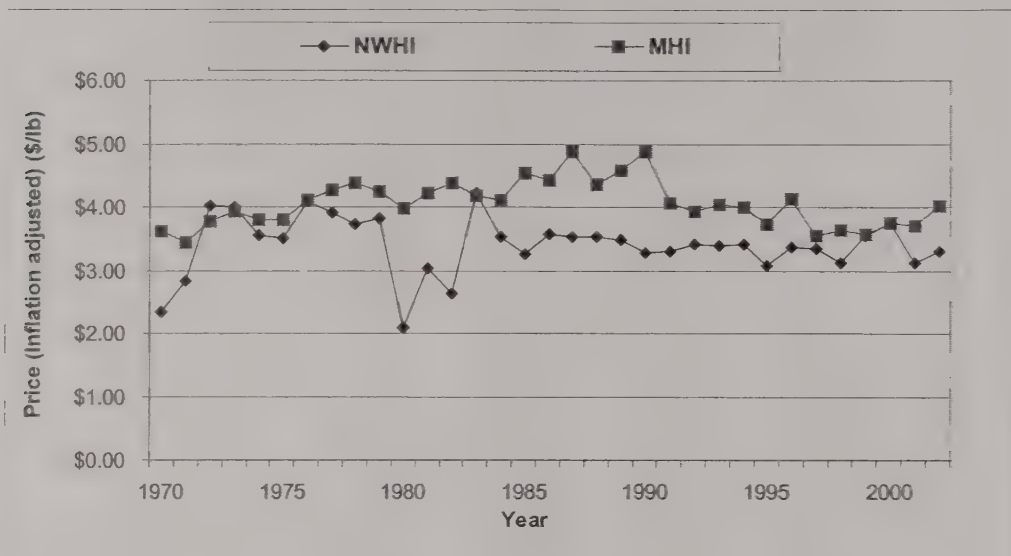
	NWHI Pounds Caught	NWHI Revenue	NWHI Revenue*	NWHI Aggregate	NWHI Aggregate Price *	HCPI
	Nominal Values		(Inflation- adjusted)	Nominal Price	(Inflation- adjusted)	
1970	74	\$39	\$172	\$0.53	\$2.34	40.9
1971	75	\$50	\$212	\$0.67	\$2.84	42.6
1972	43	\$42	\$172	\$0.98	\$4.02	44.0
1973	62	\$63	\$247	\$1.02	\$4.01	45.9
1974	49	\$49	\$174	\$1.00	\$3.55	50.8
1975	59	\$64	\$208	\$1.08	\$3.51	55.5
1976	59	\$78	\$241	\$1.32	\$4.08	58.3
1977	83	\$104	\$306	\$1.33	\$3.92	61.2
1978	143	\$194	\$531	\$1.36	\$3.72	65.9
1979	118	\$183	\$451	\$1.55	\$3.82	73.2
1980	172	\$163	\$359	\$0.95	\$2.09	81.9
1981	52	\$79	\$157	\$1.52	\$3.03	90.5
1982	77	\$108	\$203	\$1.40	\$2.63	96.0
1983	38	\$89	\$161	\$2.34	\$4.23	99.8
1984	661	\$1,350	\$2,334	\$2.04	\$3.53	104.3
1985	922	\$1,800	\$3,008	\$1.95	\$3.26	107.9
1986	869	\$1,900	\$3,106	\$2.19	\$3.58	110.3
1987	1015	\$2,300	\$3,578	\$2.27	\$3.53	115.9
1988	625	\$1,500	\$2,202	\$2.40	\$3.52	122.8
1989	303	\$756	\$1,051	\$2.50	\$3.48	129.7
1990	423	\$1,066	\$1,384	\$2.52	\$3.27	138.9
1991	387	\$1,053	\$1,275	\$2.72	\$3.29	148.9
1992	424	\$1,255	\$1,451	\$2.96	\$3.42	155.9
1993	385	\$1,164	\$1,306	\$3.02	\$3.39	160.7
1994	443	\$1,382	\$1,513	\$3.12	\$3.42	164.7
1995	369	\$1,060	\$1,135	\$2.87	\$3.07	168.4
1996	309	\$989	\$1,043	\$3.20	\$3.37	171.0
1997	346	\$1,106	\$1,158	\$3.20	\$3.35	172.2
1998	329	\$924	\$971	\$2.97	\$3.12	171.6
1999	341	\$1,102	\$1,146	\$3.42	\$3.56	173.4
2000	270	\$902	\$922	\$3.68	\$3.76	176.3
2001p	251	\$725	\$733	\$3.10	\$3.13	178.4
2002p	243	\$759	\$759	\$3.13	\$3.13	180.3
Average	306	\$739	\$1,028	\$2.10	\$3.40	111.8
Standard Deviation	265	\$645	\$921	\$0.90	\$0.47	47.6

NWHI bottomfish landings, revenue, and price by source, 1970 - 2002.

(* Inflation-adjusted.)

	MHI Pounds Caught	MHI Revenue	MHI Revenue* (Inflation-adjusted)	MHI Aggregate Price	MHI Aggregate Price * (Inflation - adjusted)	HCPI
1970	270	\$214	\$943	\$0.82	\$3.61	40.9
1971	335	\$262	\$1,109	\$0.81	\$3.43	42.6
1972	364	\$324	\$1,328	\$0.92	\$3.77	44.0
1973	392	\$355	\$1,394	\$1.00	\$3.93	45.9
1974	364	\$372	\$1,320	\$1.07	\$3.80	50.8
1975	485	\$513	\$1,667	\$1.17	\$3.80	55.5
1976	499	\$615	\$1,902	\$1.33	\$4.11	58.3
1977	479	\$660	\$1,944	\$1.45	\$4.27	61.2
1978	597	\$906	\$2,479	\$1.60	\$4.38	65.9
1979	580	\$940	\$2,315	\$1.72	\$4.24	73.2
1980	541	\$919	\$2,023	\$1.81	\$3.98	81.9
1981	591	\$1,183	\$2,357	\$2.12	\$4.22	90.5
1982	673	\$1,492	\$2,802	\$2.33	\$4.38	96.0
1983	847	\$1,882	\$3,400	\$2.31	\$4.17	99.8
1984	803	\$1,797	\$3,106	\$2.38	\$4.11	104.3
1985	765	\$1,954	\$3,265	\$2.72	\$4.55	107.9
1986	811	\$2,052	\$3,354	\$2.71	\$4.43	110.3
1987	785	\$2,345	\$3,648	\$3.14	\$4.88	115.9
1988	1,166	\$3,288	\$4,828	\$2.97	\$4.36	122.8
1989	1,007	\$3,090	\$4,296	\$3.29	\$4.57	129.7
1990	651	\$2,242	\$2,910	\$3.76	\$4.88	138.9
1991	562	\$1,713	\$2,074	\$3.35	\$4.06	148.9
1992	588	\$1,842	\$2,130	\$3.40	\$3.93	155.9
1993	462	\$1,535	\$1,722	\$3.60	\$4.04	160.7
1994	536	\$1,793	\$1,963	\$3.65	\$4.00	164.7
1995	570	\$1,818	\$1,946	\$3.48	\$3.73	168.4
1996	442	\$1,593	\$1,680	\$3.92	\$4.13	171.0
1997	519	\$1,589	\$1,664	\$3.39	\$3.55	172.2
1998	496	\$1,517	\$1,594	\$3.47	\$3.65	171.6
1999	460	\$1,393	\$1,448	\$3.43	\$3.57	173.4
2000	509	\$1,641	\$1,678	\$3.67	\$3.75	176.3
2001p	391	\$1,266	\$1,279	\$3.66	\$3.70	178.4
2002p	363	\$1,364	\$1,364	\$4.04	\$4.04	180.3
Average	588	\$1,407	\$2,287	\$2.44	\$4.08	107.4
Standard Deviation	197	\$787	\$934	\$1.02	\$0.37	45.9

Figure 10. Hawaii bottomfish ex-vessel prices* by area (NWHI vs. MHI, 1987 - 2002.
(* Inflation-adjusted.)



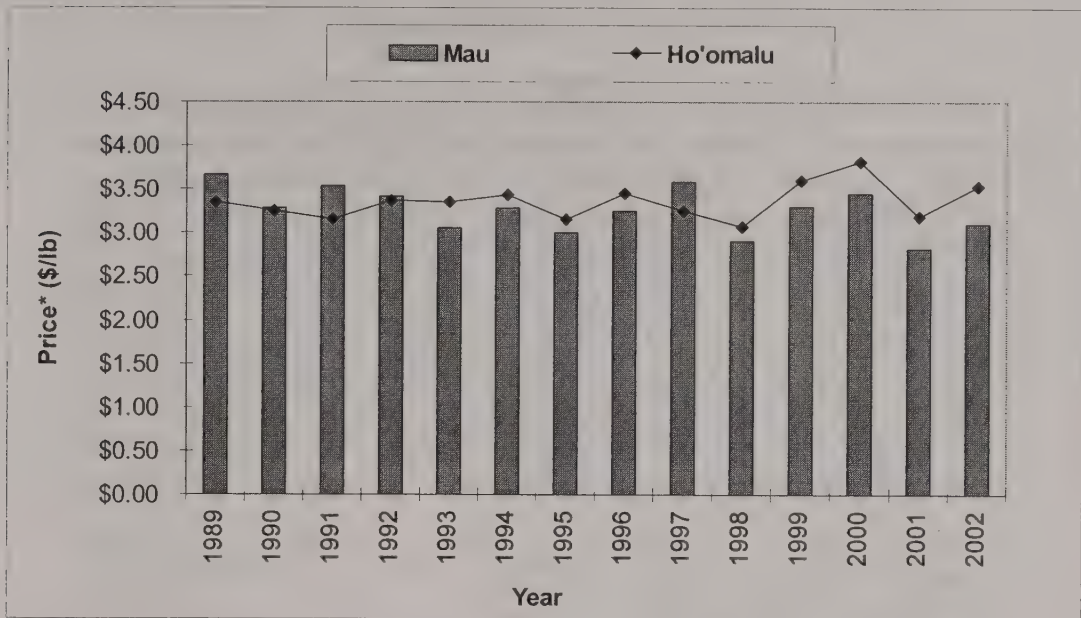
Interpretation*: Historically, bottomfish caught in the main Hawaiian Islands tended to have higher aggregate prices, reflecting both species composition and greater freshness. However, the MHI price declined in general in 1990s, while NWHI price was relatively steady during the same period. This relative lowering of the MHI bottomfish prices may have reflected the softness of the upscale part of the Hawaii market. As a result, it brought the prices to a similar range in 1999, and slightly converge in 2000 as NWHI price was \$3.76 and MHI was \$3.75.

In 2001, the prices from both areas drops, but to a greater degree for bottomfish caught in the Northwestern Hawaiian Islands. In 2002, the prices from both areas increased slightly. Again, the MHI price was higher than NWHI again in these two years.

Onaga and opakapaka comprise the largest valued landings in each area for most years (ignoring the highly fluctuating landings of uku); NWHI ex-vessel prices were \$4.53 and \$4.79 per pound respectively in CY 2002 while MHI were \$5.89 and \$5.01, respectively. However, the NWHI landings are comprised of a higher percentage of these higher priced species compared to the MHI, so the difference in price for individual species by area is ironed out by the different species compositions between the two areas.

Data: See Figure 9.

Figure 11. Hawaii Bottomfish (BMUS) Ex-vessel Prices* by NWHI zone, 1989 - 2002
(* Inflation-adjusted).



Interpretation*: Mau and Ho'omalulu zone aggregate bottomfish prices (not accounting for differences in species composition) have been roughly the same in aggregate over time but diverged rather substantially in recent years, with the Ho'omalulu receiving the highest aggregate prices. In inflation-adjusted terms, Mau zone prices have not changed substantial over the past ten years but Ho'omalulu zone aggregate prices are 15 - 20% higher than in the late 1980s and early 1990s. The prices of the two zones moved down in 2001 and up 2002, with the Ho'omalulu still receiving the highest.

However, on an individual species basis, Mau zone prices exceed those for the Ho'omalulu zone, which might be expected since there is a shorter running time from the Mau zone to markets on Oahu and Kauai. Onaga and opakapaka are respectively \$5.10 and \$4.83 per pound, ex-vessel, from the Mau zone, while from the Ho'omalulu zone the prices are \$4.41 and \$4.78. These two species composed only 23% of the bottomfish caught from the Mau zone, while 54% from the Ho'omalulu zone.

Hawaii Bottomfish Ex-vessel Prices* by NWHI zone, 1989 - present.
 (*Inflation-adjusted to current year base)

Year	Nominal Price per Pound		Inflation-adjusted Price		
	Mau	Ho'omalua	Mau	Ho'omalua	HCPI
1989	\$2.64	\$2.41	\$3.67	\$3.35	129.70
1990	\$2.53	\$2.51	\$3.28	\$3.26	138.90
1991	\$2.92	\$2.61	\$3.54	\$3.16	148.90
1992	\$2.96	\$2.92	\$3.42	\$3.38	155.90
1993	\$2.73	\$2.99	\$3.06	\$3.35	160.70
1994	\$3.00	\$3.14	\$3.28	\$3.44	164.70
1995	\$2.80	\$2.94	\$3.00	\$3.15	168.40
1996	\$3.09	\$3.27	\$3.26	\$3.45	171.00
1997	\$3.42	\$3.11	\$3.58	\$3.26	172.20
1998	\$2.77	\$2.93	\$2.91	\$3.08	171.6
1999	\$3.18	\$3.46	\$3.31	\$3.60	173.4
2000	\$3.38	\$3.74	\$3.46	\$3.82	176.3
2001p	\$2.79	\$3.15	\$2.82	\$3.18	178.4
2002p	\$3.10	\$3.53	\$3.10	\$3.53	180.3
Average	\$2.95	\$3.05	\$3.26	\$3.36	163.6
Standard Deviation	\$0.26	\$0.38	\$0.26	\$0.20	15.2

Data: Data from HDAR reports are used for NWHI for both years. Inflation-adjusted values are to current year base HCPI (Honolulu Consumer Price Index).

Data source: nwhi02kek.xls (3/12/04)

Hawaii bottomfish species landings and prices, all areas combined, 2001 & 2002.³

	2001		2002	
	Pounds	Revenue	Pounds	Revenue
Butaguchi	31,228	49,224	32,271	49,597
Ehu	37,503	126,843	27,704	106,580
Hapuupuu	37,437	133,846	38,044	149,244
Onaga	128,414	569,700	124,389	675,353
Opakapaka	156,416	653,372	145,881	681,039
Uku	117,280	266,732	116,798	273,855
Ulua	7,862	10,198	9,506	10,880
Other BMUS	92,963	124,466	80,095	128,345
Other Bottomfish	33,518	59,056	31,886	49,385
Total Bottomfish	642,621	1,993,437	606,574	2,124,279
Average Ex-vessel Price per Pound				
	2001		2002	
Butaguchi	\$1.73		\$1.62	
Ehu	\$3.69		\$4.01	
Hapuupuu	\$3.78		\$4.04	
Onaga	\$4.67		\$5.29	
Opakapaka	\$4.41		\$4.88	
Uku	\$2.43		\$2.44	
Ulua	\$1.48		\$1.54	
Other BMUS	\$1.82		\$1.97	
Other Bottomfish	\$2.20		\$2.22	
Total Bottomfish	\$3.43		\$3.74	

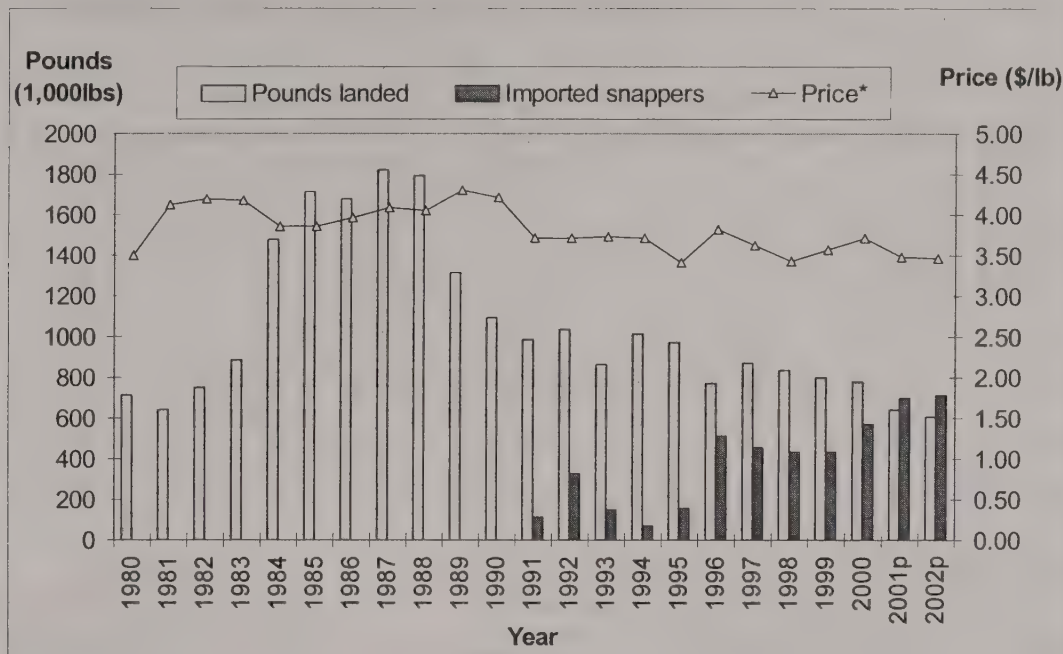
³ Small differences may exist between species totals and area totals due to rounding.

Interpretation: Species prices show the significance of species composition in aggregate statistics since prices vary from \$5.29 per pound, ex-vessel, for onaga to \$1.57 for ulua. The generally higher species prices in 2002 probably reflect the improved economic climate in Hawaii and the resulting increased demand for fresh seafood.

Data & Data Sources: NMFS estimates from shoreside monitoring are used for NWHI landings from 1984-96. HDAR landings are again used for NWHI landings from 1997-2001. For 2002, data from HDAR reports are used for NWHI for the entry year, but for MHI only from January to September, due to the form changes in HDAR catch reports. HDAR Dealer reports are used for MHI for the last three months (October to December in 2002).

Data imported from: b8702xnb.xls (3/12/04)

Figure 12. Hawaii bottomfish demand (annual, inflation-adjusted ex-vessel price* and supplies (domestic landings and imported fresh snappers), 1980 - present.)

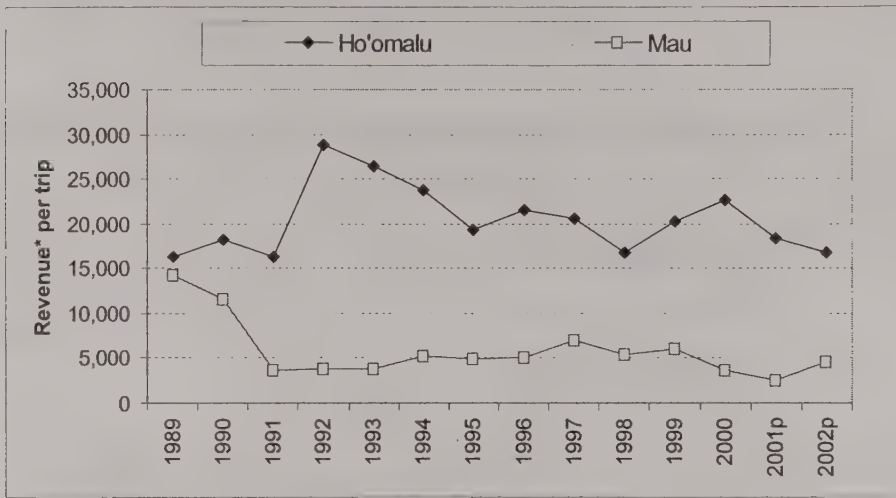


Interpretation*: Economic research in the mid-1980s showed a considerable (negative) relationship between weekly bottomfish landings and ex-vessel price. However this relationship is not shown for the annual data. As shown by this and the earlier figure, despite a considerable decrease in total landings since 1987, inflation-adjusted ex-vessel price has been slightly declined over the past decade. The impact of imports may be significant. Based on the U.S. Census statistics, fresh bottomfish, mainly snappers, have been imported to Hawaii market since 1991 and the imported volume has increased substantially. In recent years, 2001 and 2002, the imported fresh snappers supplied more than half of the local market and the average price of imported snappers were around \$2.70 per pound, one dollar lower than the local bottomfish price.

Data: See Figure 9 for domestic landings and price data. Imported snapper information is based on the data recorded by U.S. Census Bureau, maintained by NMFS market news, http://www.st.nmfs.gov/st1/market_news/. The import data are available in the web site since 1989. Since the imported fish snappers did not appear in the data until 1991, it is not sure that the imported fresh snappers were zero or information was not available prior to 1989.

Price* represents nominal revenue adjusted for inflation by the Honolulu Consumer Price Index (HCPI) to the current year.

Figure 13. NWHI bottomfish inflation-adjusted revenue* per trip by zone, 1989 - present.



Interpretation*: The two trends in inflation-adjusted revenue per trip show the distinct difference between Ho'omaluu and Mau zone operations. When the limited entry provisions began to take effect in the Ho'omaluu zone in 1989-91, revenue rose dramatically but has subsequently declined to slightly more than its average for the period. Revenue (inflation-adjusted) in the Mau zone initially fell (as the limited entry vessels could no longer fish in the Mau zone, only smaller boats remained in the Mau zone). After that initial drop, however, revenue per trip in the Mau zone rose for several years, but has subsequently declined from 1997 to 2001. In 2002, revenue per trip for the vessels fishing in Ho'omaluu declined, while it increased in Mau zone. The limited entry program, which was implemented in Mau zone since 2001, may have improved the economic performance for the vessels that has a permit to fish in Mau zone.

Additional trip revenue to bottomfish vessel, in some cases a substantial proportion, comes from non-bottomfish landings outside the bottomfish grounds of the NWHI. Thus additional revenue was not included in this graph.

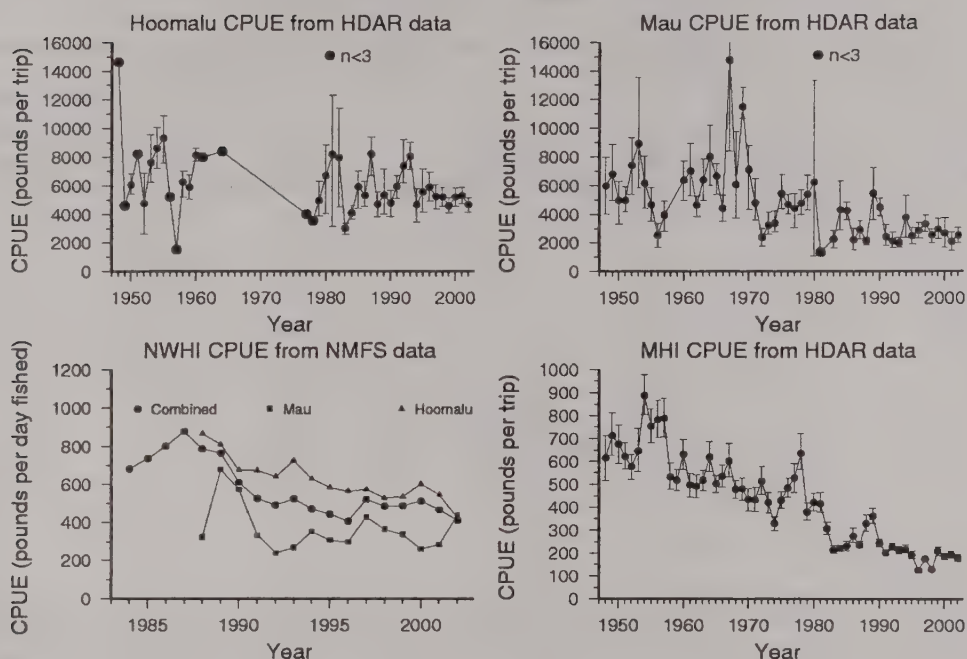
NWHI bottomfish inflation-adjusted fleet-wide revenue* and
revenue* per trip by zone, 1989 - present.

Year	Ho'omalau Zone			Mau Zone		
	Trips	Revenue per trip	Revenue* per Trip	Trips	Revenue per trip	Revenue* per trips
1989	28	11,788	16,387	22	10,211	14,195
1990	25	14,015	18,387	55	8,904	11,558
1991	47	13,514	16,364	84	2,981	3,610
1992	37	24,989	28,900	55	3,273	3,785
1993	34	23,527	26,397	72	3,327	3,733
1994	41	21,706	23,762	99	4,746	5,196
1995	33	18,021	19,294	97	4,584	4,908
1996	26	20,387	21,496	81	4,757	5,016
1997	38	19,736	20,664	53	6,702	7,017
1998	50	16,006	16,817	39	5,130	5,390
1999	48	19,480	20,255	30	5,832	6,064
2000	32	22,174	22,677	44	3,639	3,722
2001p	41	18,146	18,339	55	2,564	2,591
2002p	26	16,746	16,746	76	4,576	4,576
Average	36	18,588	20,463	62	5,088	5,812
Standard Deviation	8.0	3,890.5	3,863.5	23.9	2,219.1	3,238.8

Data: Data are compiled from NMFS shoreside market monitoring for 1984-95 and then combined with HDAR data for 1996 and 1997. Since 1998, data is compiled from HDAR figures. Revenue is adjusted for inflation to the current base year by the Honolulu consumer price index.

Data Source: Imported from nwhikek02.xls (3/16/04)

Figure 14-a. CPUE for Hawaiian bottomfish



Interpretation: Decreases in MHI CPUE to about 30% of early CPUE values (mean of the first 5 years recorded) signify a strong yellow light condition for the fishery in this area. In the Mau zone CPUE has dropped from earliest values to 41% and 102% for trip based and daily based CPUE respectively, a borderline condition when viewed on a per trip basis, but extremely high when viewed on a per day basis. For the Hoomalu zone these values are 61% and 56 % respectively, a healthy condition.

Comments: The MHI CPUE value for 2002 is about 8% lower than the 2001 value, but remains above the 1996-1998 values. The 1999 increase in MHI CPUE was due primarily to a large increase in uku, and to a lesser degree onaga, catches and catch rates. This high in CPUE is similar to that of the late 1980s which was due to increased uku catch rates alone and may not indicate an increase in abundance of other species in either case. With the exception of lower values in 1996 and 1998, MHI catch rates have remained relatively stable since 1991.

In the Mau zone, trip CPUE increased from the 2001 value to about 41% of early values. On a catch per day basis, the Mau 2001 CPUE increased markedly to 102% of earliest values. Although the 2002 values for both increased over 2001 levels the two values do give a somewhat

conflicting indication of resource abundance. Comparatively low values on a per trip basis may be due, in part, to the recent loss of highliner vessels from the fleet. Daily CPUE values are a better indication of abundance and show a marked increase over last year. This increase may be due to changes in targeting with fishers spending more effort on BMUS vs pelagic resources.

In the Hoomalu Zone CPUE values dropped from 2001 values on both a daily and trip basis. This decline may be due, in part, to the loss of a highliner vessel in 2002.

The trip CPUE values are used for NWHI SPR calculations because they form a longer time series of data and may better estimate virgin fishery catch rates. There are no correction factors for possible changes in trip duration or fleet composition or behavior.

Source: MHI CPUE is based on HDAR C-3 catch report data from commercial fishermen. Two NWHI CPUE's are presented. Trip based CPUE is derived from HDAR C-3 catch report data from the earlier years and more recently from HDAR trip sales reports. Daily CPUE is currently derived from HDAR daily catch logs. In earlier years, HDAR data was combined with the NMFS vessel interview program catch data to obtain appropriate data and full coverage.

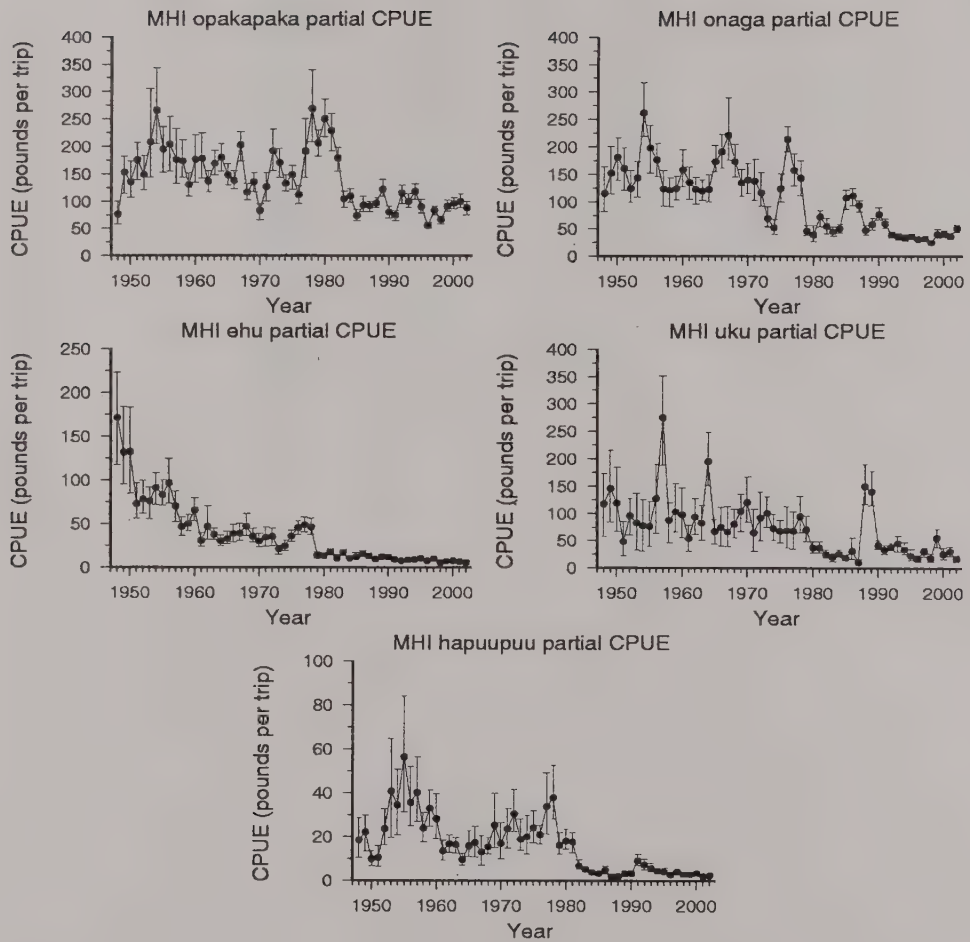
Calculation & Adjustment: MHI trips were screened to only include trips from the areas of Maui, Lanai, Molokai, and Penguin Banks that had at least 90% of the catch by weight in bottomfish. Additionally, some MHI small boats were excluded based on minimum annual landings criteria to correct for temporal changes in the fleet composition (licensees must land at least 30% of the median value of the top ten producers to qualify). The NMFS vessel interview data prior to 1988 does not allow separate Mau and Hoomalu CPUE calculations; therefore, the combined area NWHI CPUE is presented as well. The NWHI trip CPUE used data screened to only include trips where at least 90% of the catch by weight was bottomfish and at least 1000 pounds of bottomfish were caught. All catch data reported by the same licensee on consecutive days were collapsed to a trip summary, since 1) most other reports are apparent multi-day trip summaries, and 2) consecutive day reporting may be reflective of marketing rather than fishing activity. There was an apparent absence of Hoomalu Zone trips from the mid-1960s until the late-1970s. The 95% non-parametric confidence intervals for the HDAR CPUE's were calculated by bootstrapping.

Figure 14-a data summaries:

Year	Pounds/Trip			Year	Pounds/Trip		
	MHI	Mau	Hoomalu		MHI	Mau	Hoomalu
1948	614	5968	14635	1977	527	4387	4000
1949	713	6799	4614	1978	635	4753	3550
1950	677	4966	6072	1979	380	5361	4951
1951	621	4980	8228	1980	421	6210	6687
1952	577	7407	4766	1981	416	1336	8167
1953	645	8937	7627	1982	307	NA	7953
1954	887	6158	8613	1983	214	2242	3025
1955	755	4659	9336	1984	220	4308	4085
1956	784	2523	5202	1985	230	4239	5909
1957	789	3958	1535	1986	274	2206	5301
1958	533	NA	6254	1987	237	2889	8187
1959	519	NA	5897	1988	329	2136	4702
1960	630	6379	8139	1989	361	5412	5328
1961	496	6999	7978	1990	245	4454	4793
1962	491	4641	NA	1991	202	2413	5928
1963	518	6410	NA	1992	228	2092	7388
1964	619	8028	8390	1993	213	1992	8040
1965	503	6656	NA	1994	218	3748	4651
1966	536	4413	NA	1995	193	2460	5544
1967	602	14749	NA	1996	125	2823	5870
1968	478	6055	NA	1997	176	3294	5234
1969	480	11484	NA	1998	130	2518	5198
1970	433	7111	NA	1999	209	2926	4605
1971	433	4784	NA	2000	187	2654	5212
1972	514	2386	NA	2001	194	2066	5300
1973	421	3224	NA	2002	179	2496	4651
1974	329	3367	NA	mean	428	4703	6135
1975	430	5439	NA	s.d	195	2510	2199
1976	485	4653	NA				

Year	NMFS NWHI CPUE (lb/day)		
	Mau	Hoomalu	Combined
1984	NA	NA	682
1985	NA	NA	736
1986	NA	NA	800
1987	NA	NA	877
1988	322	866	786
1989	677	808	763
1990	573	675	611
1991	333	671	525
1992	239	639	491
1993	267	723	523
1994	353	629	526
1995	306	582	442
1996	298	563	407
1997	429	574	521
1998	364	527	484
1999	337	534	486
2000	260	601	513
2001	283	543	467
2002	438	412	425
mean	365.27	623.13	585.79
s.d.	121.02	114.89	141.07

Figure 14-b. Partial CPUE for MHI bottomfish



Year	MHI Partial CPUE (lb/trip)				
	OPA	ONA	EHU	UKU	HAP
1948	77	115	172	117	18
1949	153	153	132	146	22
1950	135	182	132	119	10
1951	176	161	73	48	11
1952	149	124	78	95	24
1953	208	144	76	82	41
1954	266	262	91	77	35
1955	195	198	83	76	56
1956	204	177	97	127	36
1957	176	124	70	275	40
1958	174	121	47	88	24
1959	130	124	50	103	33
1960	177	158	66	97	28
1961	178	136	31	54	13
1962	136	123	47	94	17
1963	169	120	38	82	16
1964	180	122	30	195	9
1965	148	174	33	67	16
1966	138	191	38	75	17
1967	203	222	39	66	13
1968	116	174	47	81	15
1969	135	135	35	104	25
1970	83	140	30	120	17
1971	127	138	34	65	24
1972	192	116	35	92	31
1973	171	70	21	101	19
1974	132	52	24	72	20
1975	149	124	36	68	24
1976	112	214	45	69	21
1977	191	158	49	67	34
1978	269	143	46	94	38
1979	207	47	13	70	16
1980	251	40	13	37	18
1981	229	72	18	37	18
1982	179	55	11	25	7
1983	104	46	17	20	5
1984	109	51	10	26	4
1985	74	107	12	18	3
1986	93	111	15	31	5
1987	91	93	13	10	2
1988	97	48	9	150	2
1989	122	59	12	140	3
1990	80	77	12	42	3
1991	75	60	9	34	9
1992	115	39	8	39	7
1993	100	37	9	46	6
1994	118	34	9	34	4
1995	96	40	11	26	5
1996	56	31	8	18	3
1997	84	32	10	30	4
1998	66	25	6	19	3
1999	91	41	7	55	3
2000	96	41	8	26	3
2001	100	36	7	30	2
2002	88	51	6	17	2
mean	141.27	106.69	37.78	72.65	16.09
s.d	52.57	59.16	35.93	48.94	12.65

Interpretation: Reduction of species-specific CPUE for species presented here, with the exception of opakapaka, to less than half of their early values would suggest a yellow light situation for all of these species. Caution must be used in this interpretation because factors such as targeting of effort to specific species is not taken into account (see next section for targeted effort).

Comments: All CPUE time series remain highly variable. All 2002 partial CPUE values are well below their long-term averages. There are apparent declines in most species when comparing several years of recent values with values earlier in the time series. The decline is least apparent in opakapaka and most apparent in ehu.

Source: The partial CPUE for the MHI is based on HDAR catch report data from commercial fishermen.

Calculation & Adjustment: The same subset of HDAR data as used in Fig. 14-A is used here, but the weight of each species is tabulated separately rather than in aggregate. The same denominator value used in Fig. 14-A is used here (# trips fished), i.e. summing these five partial CPUE's (and remaining BMUS CPUE's) will approximate the Fig. 14-A estimates. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 14-c. Partial targeted CPUE for MHI bottomfish

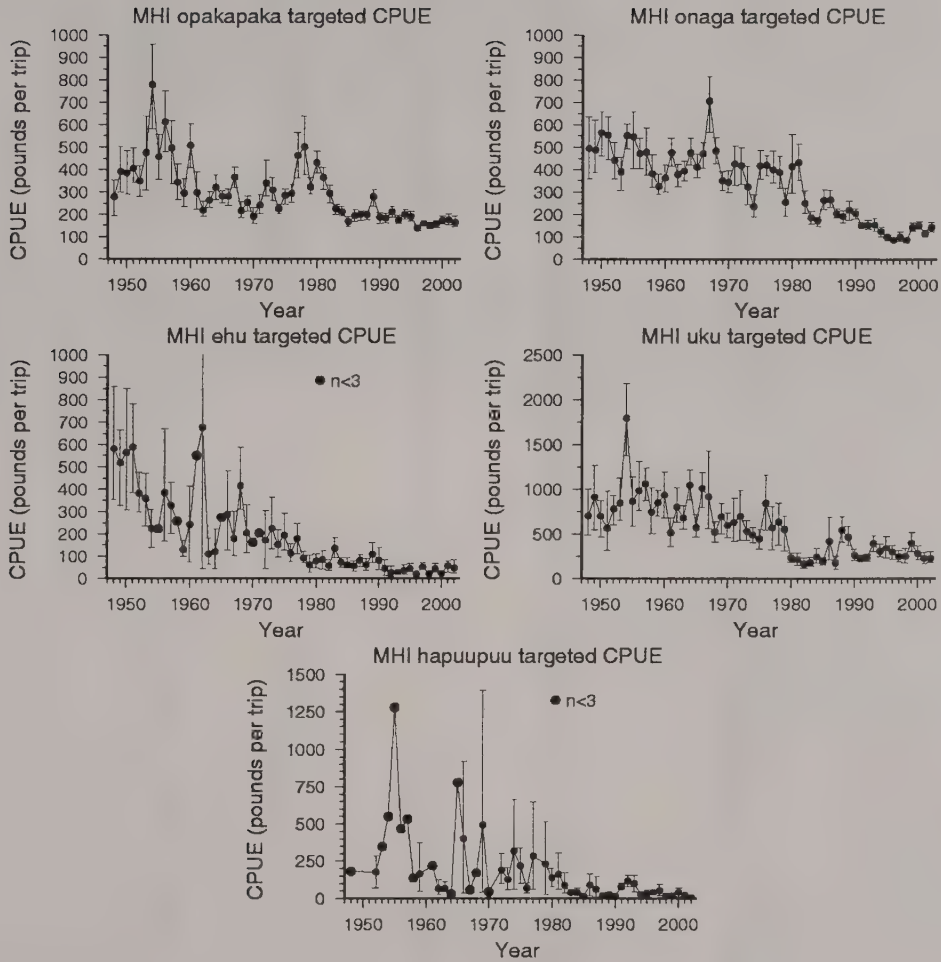


Figure 14-c data summary:

Year	MHI Targeted CPUE (lb/Trip)			
	Opakapaka	Onaga	Ehu	Uku
1948	277	496	581	705
1949	391	488	517	913
1950	385	566	564	701
1951	406	554	589	567
1952	348	442	380	779
1953	476	390	358	850
1954	779	552	224	1796
1955	458	547	222	869
1956	613	473	384	988
1957	496	479	327	1061
1958	344	382	257	745
1959	293	325	130	852
1960	507	364	242	939
1961	297	476	550	514
1962	216	379	677	806
1963	263	394	111	683
1964	320	475	120	1046
1965	281	411	275	574
1966	280	472	288	1014
1967	366	706	180	919
1968	215	484	415	525
1969	254	353	203	696
1970	191	345	161	600
1971	241	428	205	634
1972	339	420	171	699
1973	309	324	226	531
1974	225	236	152	488
1975	284	419	194	448
1976	293	421	112	846
1977	462	400	178	573
1978	501	389	92	640
1979	323	255	61	552
1980	430	415	79	235
1981	364	433	83	212
1982	293	252	58	164
1983	225	186	135	179
1984	212	173	72	241
1985	168	266	63	193
1986	194	267	58	418
1987	199	206	82	175
1988	198	192	60	549
1989	278	221	109	468
1990	187	205	82	260
1991	183	153	45	224
1992	212	154	27	238
1993	176	155	28	393
1994	200	125	37	311
1995	191	100	45	343
1996	138	88	21	300
1997	161	101	52	250
1998	148	87	21	251
1999	158	145	44	398
2000	174	150	23	282
2001	176	116	58	228
2002	164	144	47	230
mean	295.67	330.53	190.45	565.36
s.d.	129.29	152.74	171.86	315.83

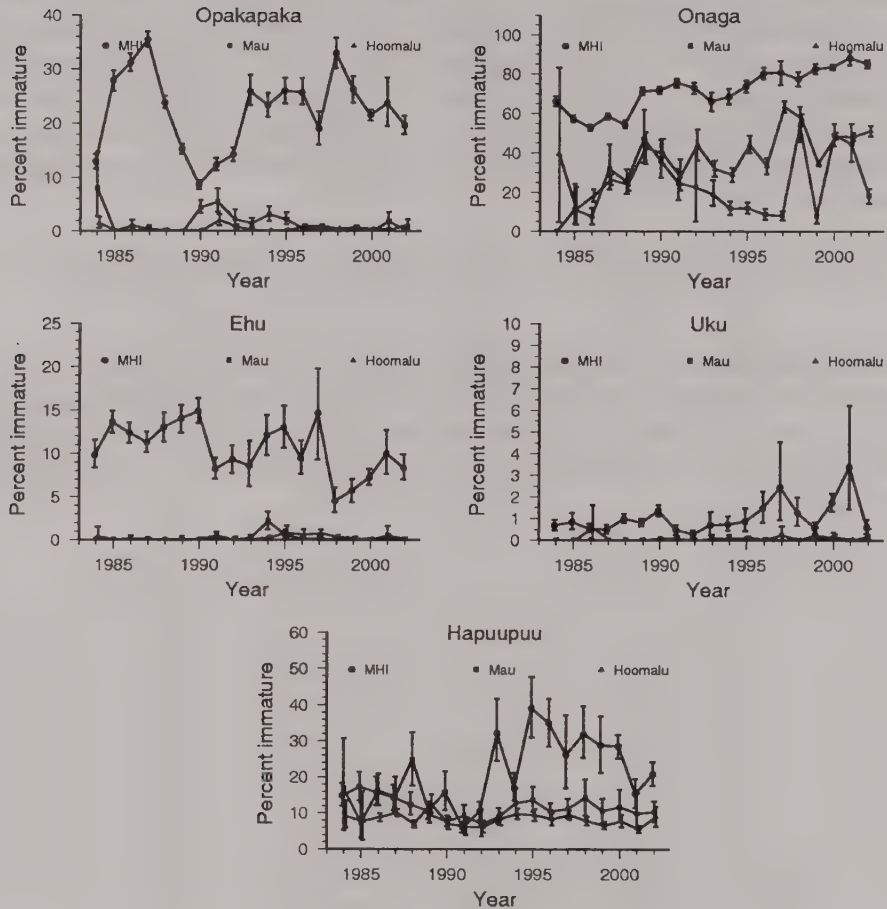
Interpretation: Comparison of 2002 CPUE values with the first 5 years available (1948-52) indicate that all four species for which sufficient data is available have CPUE values less than or equal to 50% of original values. These values represent a yellow light or borderline condition for these four species in the MHI, with the ehu stocks being the most stressed.

Comments: As in Fig. 14-B, there are apparent declines when comparing recent years with values earlier in the time series. The decline is least apparent in opakapaka (45% of original values) and most apparent for ehu (9% of original values). The level of screening done here severely reduces the size of the sample, and this may contribute to some of the observed variability, particularly for ehu where there are fewer targeted trips. Values for hapuupuu are graphed but not put in the table due to the extremely small numbers of targeted trips in most years making the values unreliable.

Source: The partial targeted MHI CPUE is based on HDAR catch report data from commercial fishermen.

Calculation & Adjustment: The data used in Fig. 14-A were further screened to only include trips where at least 50% of the total catch by weight is the target species. This can only be done for species that are targeted successfully; incidental catch species will not contribute significantly enough to the overall catch. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 15. Percent immature in Hawaiian bottomfish catch



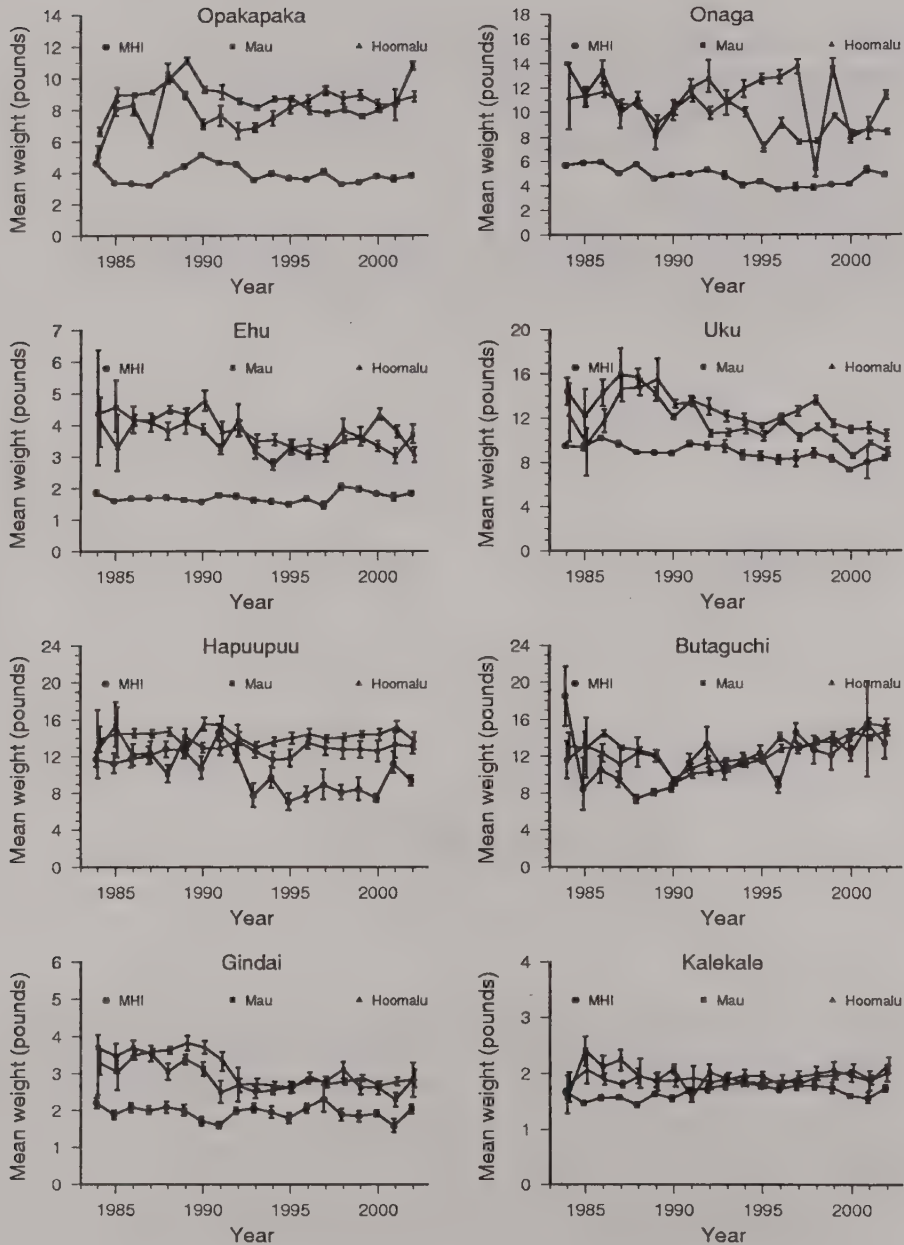
Interpretation: MHI onaga catch has the highest percentage of immature fish, and is the only one consistently over 50%. In 2002 the MHI onaga landings comprised of 85% immature fish, signifying a yellow light condition for this species in this zone. This is, however, a slight improvement over 2001 (88%). In the NWHI zones onaga showed high % immature values for 1997 and 1998 in the Hoomalu zone and 1998 in the Mau zone. 2002 values for the Hoomalu zone is just above 50% whereas that for the Mau zone dropped to 18%. All other MHI and NWHI values are in the healthy range for percentage of immature fish in the catch.

Comments: MHI catch is comprised of more immature fish than NWHI catch for all species. In all areas onaga values are the highest on average. Percent immature for uku are the lowest (i.e. healthiest) values in all zones. Among the other species, MHI opakapaka experienced periods of relatively high values (peaking in the years 1985-87) and a sharp rise in 1998. MHI hapuupuu percent immature declined from a peak in 1995 to moderate levels in 1997-2002.

Source: Prior to 2000 fish size data is derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS and WPRFMC personnel. Data for 2000 through the present is from dealer sales records. Size at maturity from Everson (1984), Everson (1990 unpub. rep.), Everson et al. (1989), Kikkawa (1984), Sudekum et al. (1991).

Calculation & Adjustment: The percent immature is calculated in terms of weight. The size distribution of sold fish is assumed to be representative of all fish caught. Maturity was assumed to be "knife-edge", and all fish in the same sales lot were assumed to be of equal size. 95% non-parametric confidence intervals were calculated by bootstrapping.

Figure 16. Mean weight of Hawaiian bottomfish



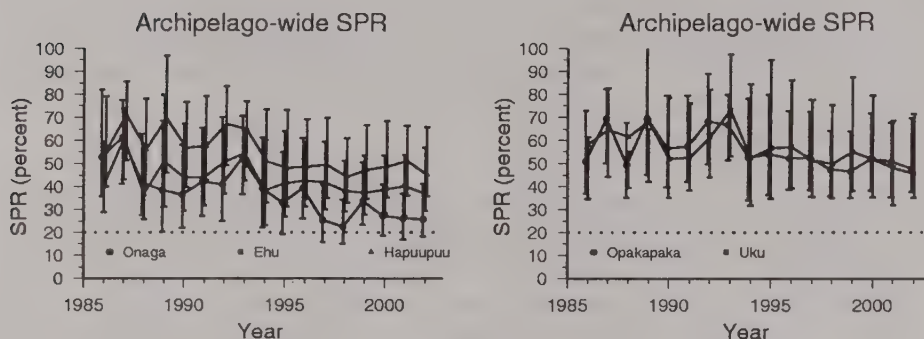
Interpretation: MHI mean weights are considerable lower than NWHI weights indicating considerable stress on these resources. No noticeable trends can be seen in NWHI mean weights, indicating relative health in these zones. Low mean weights were first recorded for MHI hapuupuu in 1993 and remained low through 2000, but show a sharp increase in 2001 followed by a slight decrease in 2002. The small number of fish upon which the annual estimates are based may bias the results for this species. Both onaga and opakapaka showed an increase in mean weight in the Mau zone.

Comments: Mean weights of fish in the NWHI catch appear generally stable over time, with the notable exception of the onaga mean weight, where recent declines can be seen for the Hoomalu zone. The 1998 Mau onaga value is the lowest on record showing a sharp decline from earlier values with a return to normal levels in 1999 then another drop in 2000 and increases in 2001 and 2002. MHI values have been remarkably stable for most species over the time series available. The two most important changes in 2002 are the sharp increases in mean size of the Mau zone onaga and opakapaka.

Source: Prior year's fish size data was derived from auction lot statistics obtained at the Honolulu UFA auction by HDAR, NMFS, and WPRFMC personnel; 2000 data is from HDAR dealer reports.

Calculation & Adjustment: The size distribution of sold fish is assumed to be representative of all fish caught. All fish in the same sales lot were assumed to be of equal size.

Figure 17. Archipelago-wide Spawning potential ratio (SPR)



Archipelago-wide SPR:

Year	SPR (%)				
	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
1986	41	55	53	51	58
1987	61	71	61	69	65
1988	37	56	42	49	62
1989	51	70	38	69	68
1990	44	57	36	57	52
1991	44	58	42	57	53
1992	51	67	41	68	61
1993	54	65	53	67	73
1994	38	51	39	53	52
1995	41	48	33	54	56
1996	43	49	39	52	57
1997	42	49	25	52	51
1998	38	44	22	47	50
1999	37	47	34	46	55
2000	39	49	27	52	52
2001	40	51	26	51	48
2002	37	45	26	47	45
mean	43.41	54.82	37.47	55.35	56.35
s.d.	6.91	8.71	10.89	7.98	7.42

Interpretation: SPR values for the five major BMUS species are all above the 20% critical threshold level when viewed on an archipelago-wide basis. Of these species, onaga usually has the lowest value with the 2002 value at 26%. This low value for onaga is due to the consistently poor condition of the resources in the MHI. Now that the state management plan for the MHI bottomfish has been implemented, it is likely that the condition of onaga resources in this area will improve and the archipelago-wide SPR value will increase over time. In fact, the onaga SPR values for the last four years are all above the 1998 low of 22%.

The archipelago-wide SPR estimates are the best method available to assess the Hawaii bottomfish resources and should be the only values used to evaluate overfishing. SPR values are

also presented in this document on a management zone basis for the purpose of determining locally depleted resources. It is the best policy to have all zones in a healthy condition and actions should continue to be implemented to assure the achievement of this goal. For the purpose of determining an overfished resource, however, the archipelago-wide condition is what should be measured. Evidence from larval drift simulation and preliminary genetic work point to as single archipelago-wide stock with substantial larval transfer between zones (generally from the more healthy northwestern zones toward the more depleted MHI zone).

Comments: SPR values for all species fluctuate annually and have wide error bars. The values for the second half of the nearly 20 year time series are lower than those of the first half, but the only species showing current signs of concern is the onaga for which the lower bound dips below the 20% critical threshold value. The management measures implemented by the state for the MHI should bring improvement of the MHI onaga resource over a period of a few years. Any improvements to the MHI resources will contribute to improvement of the archipelago-wide condition as well.

Source: Data used in calculating archipelago-wide SPR is derived largely from HDAR commercial catch records integrated with NMFS interview data in some cases. Also important is the size frequency data obtained from market sampling by HDAR and NMFS and dealer reports. The final component is the weighting factor for each management zone, which is based on the percentage of total 100 fathom contour contained in each zone.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Preweighted SPR values (point estimates and upper and lower bounds) are from the area specific estimates found in the following section (Figure 18, 18a, b, and c). NWHI estimates are calculated using area specific maturity estimates and partial CPUE values (where area specific landings of each species are divided by the total effort expended in the management zone). For the MHI, hapuupuu SPR estimates are calculated similarly to those for NWHI fish. For the remaining MHI species, however, targeted trips are identified and the landings and effort for these targeted trips only are used to calculate CPUE for these species. Weighting factors are applied to point estimate and upper and lower bounds for each species and management zone. Archipelago-wide values are derived by adding the zone specific components. The weighting factors are: MHI = 0.447, Mau zone = 0.124, Hoomalu zone = 0.429.

Figure 18. Spawning potential ratio (SPR) for MHI bottomfish

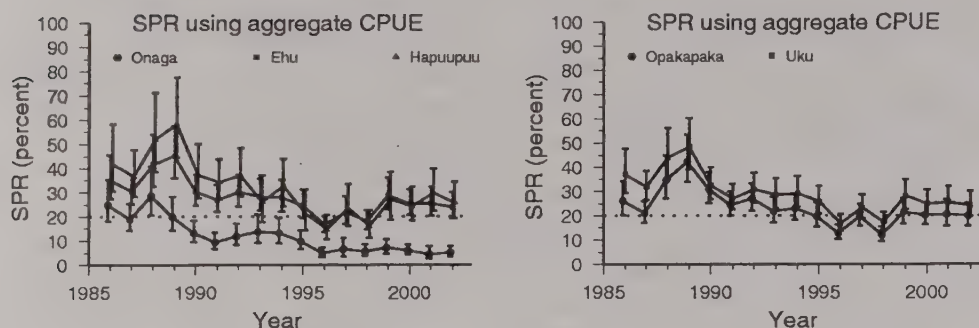


Figure 18 data summary:

Year	SPR (%)				
	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
1986	35	42	25	26	37
1987	31	37	19	21	32
1988	42	52	29	35	44
1989	45	58	20	42	48
1990	30	37	13	31	33
1991	27	34	9	24	27
1992	30	37	12	27	31
1993	28	26	14	22	29
1994	28	33	13	23	29
1995	24	21	10	20	26
1996	16	15	6	13	23
1997	22	23	6	20	23
1998	18	16	6	12	17
1999	29	27	7	21	28
2000	25	24	6	20	25
2001	25	30	4	20	25
2002	24	26	5	20	24
mean	28.18	31.65	12.00	23.35	29.47
s.d.	7.43	11.63	7.38	7.37	7.76

Interpretation: The peak SPR values observed in 1988-1989 for all species were largely a response to increases in aggregate CPUE due to increased uku landings and catch rates. 2002 SPR values show improvements over low values for the major BMUS species, other than onaga, in 1997 with the exception of onaga which shows an all time low for 2001. The improvement is largely due to an increase in aggregate CPUE over the low 1997 value. The 2002 value presented here for MHI hapuupuu is the best estimate of MHI SPR available, because we cannot calculate an SPR for this species using targeted CPUE. For the remaining species, the next section (Figure 19-A) gives the best estimation of 2002 MHI SPR.

Comments: Current SPR estimates for onaga in the MHI is below the twenty percent critical

threshold level indicating localized resource depletion. Onaga remains below 20% for the 13 years in a row.

Source: SPR is estimated from the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from data reported to HDAR by commercial fishermen. Additional information for opakapaka obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations use similar methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-1952 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish from the areas of Maui, Lanai, Molokai, and Penguin Banks (see Fig. 14-A for more details). Virgin catch size composition is estimated from the 1986-1988 NWHI catch data, and current catch size composition is estimated from single year MHI catch data. All SPR values may have changed slightly from previous year's reports due to more complete reporting and improvements in the calculations. The 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

Figure 19-a. Spawning potential ratio (SPR) for MHI bottomfish using targeted CPUE

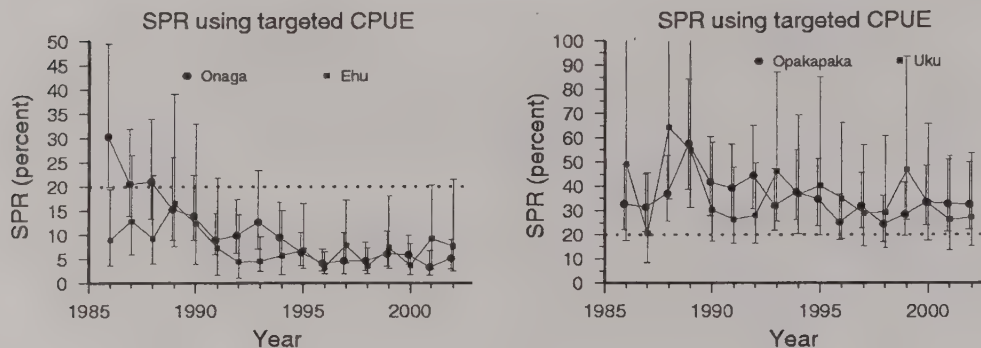


Figure 19a data summary:

Year	SPR (%)			
	Opakapaka	Onaga	Ehu	Uku
1986	32.71	30.37	8.99	49.11
1987	31.43	20.60	12.91	20.57
1988	36.88	21.03	9.30	64.24
1989	57.60	15.31	16.54	54.86
1990	41.73	13.86	12.32	30.29
1991	39.18	8.99	7.23	26.37
1992	44.41	9.95	4.37	28.01
1993	31.93	12.65	4.56	46.13
1994	37.48	9.49	5.76	36.51
1995	34.59	6.34	6.85	40.17
1996	25.10	4.12	3.36	34.96
1997	31.85	4.63	7.85	28.81
1998	24.30	4.68	3.53	29.28
1999	28.40	6.12	7.36	46.74
2000	33.33	5.94	3.72	32.76
2001	30.29	3.07	11.10	27.27
mean	35.08	11.07	7.86	37.26
s.d.	8.12	7.60	3.83	11.96

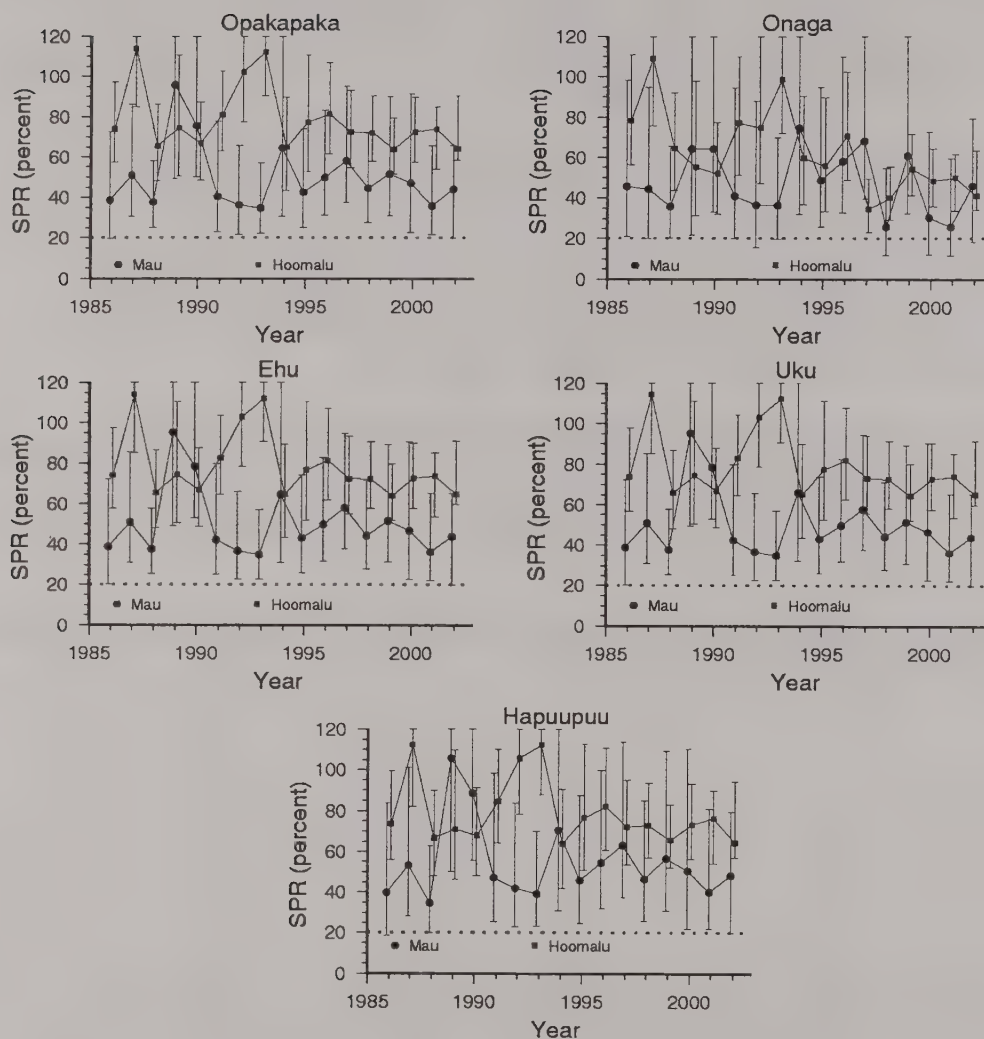
Interpretation: We feel that SPR values obtained here may better represent the condition of the MHI resources in regards to localized depletion than those found in the previous section. Ehu and onaga stocks are clearly stressed and well below the 20% SPR threshold, with ehu below the 20% level for the duration of our data and onaga on a continuing downward trend with values below 20% for the last 13 years. Contrary to the results obtained in the previous section, opakapaka and uku SPR levels have remained above the 20% mark for all years sampled and do not indicate critical locally depleted conditions.

Comments: Targeted SPR values are available for only four of the BMUS species present in the MHI. As expected onaga and ehu values are below the 20% critical level and have been for many years. Opakapaka SPR values are higher using targeted CPUE compared to using aggregate CPUE. It should be noted that values reported here do not take into consideration any improvements to the stock resulting from State of Hawaii MPAs. If data were obtained on abundance and size of fish within the reserves, then estimates of CPUE, mean size, percent immature in the catch, and ultimately SPR could be made.

Source: SPR values are estimated using dealer reports; the Honolulu UFA auction size frequency data collected by HDAR, NMFS, and WPRFMC personnel; CPUE estimates from C-3 form data reported to HDAR by commercial fishermen and screened for trips targeting particular species. Additional information for opakapaka was obtained from size frequency data of fish caught from the R/V Townsend Cromwell.

Calculation & Adjustment: Calculations are conducted as in the previous section with targeted CPUE substituting for aggregate CPUE.

Figure 19-b. Spawning potential ratio (SPR) for NWHI bottomfish



Interpretation: The correlation of SPR values among species is due the high dependence of SPR on the CPUE component, given that the maturity component is nearly negligible for most species. All species utilize the same aggregate bottomfish CPUE component. The maturity component is small relative to MHI SPR calculations because 1) the NWHI catch is primarily mature fish, and 2) the current catch size composition is relatively unchanged from the best estimate of the virgin catch size composition.

Figure 19b data summary:

SPR (%)					
Mau Zone					
Year	Ehu	Hapuupuu	Onaga	Opakapaka	Uku
1986	39	40	46	39	39
1987	51	53	44	51	51
1988	38	35	36	38	38
1989	95	106	64	96	95
1990	78	89	64	75	78
1991	42	47	41	40	42
1992	37	42	36	36	37
1993	35	39	36	35	35
1994	65	71	75	64	66
1995	43	46	49	43	43
1996	50	55	58	50	50
1997	58	63	68	58	58
1998	44	47	26	44	44
1999	52	57	61	52	51
2000	47	51	30	47	47
2001	36	40	26	36	36
2002	44	48	46	44	44
mean	50.24	54.65	47.41	49.88	50.24
s.d.	16.11	18.76	15.21	16.04	16.16
Hoomalu Zone					
1986	74	74	78	74	74
1987	114	112	109	114	114
1988	66	67	65	66	66
1989	74	71	55	74	74
1990	67	68	52	67	67
1991	83	85	77	81	83
1992	103	106	75	102	103
1993	112	112	99	112	112
1994	65	64	60	65	65
1995	77	77	56	77	77
1996	81	82	71	81	81
1997	72	72	35	72	73
1998	72	73	40	72	73
1999	64	66	54	64	64
2000	73	73	48	72	73
2001	74	76	50	74	74
2002	65	65	41	64	65
mean	78.59	79.00	62.65	78.29	78.71
s.d.	15.91	15.87	20.25	15.87	15.86

Comments: Current SPR estimates for all five species in both zones are above the 20% critical threshold level indicating healthy resources on a local scale, though lower confidence limits often are near or slightly below this level. Mau Zone SPR estimates tend to be lower than Hoomalu Zone SPR estimates for most species and years, and onaga SPR estimates tend to be slightly lower than those for most other species in most years. Notable increases in 1999 onaga SPR values for the Mau and Hoomalu zones are due to decreases in the percent of immature onaga in the catches of these zones in that year.

Source: SPR estimated from Dealer reports or Honolulu auction size frequency data collected by NMFS personnel, and CPUE estimates from data reported to HDAR by commercial fishermen.

Calculation & Adjustment: Calculations use same methodology as presented in Somerton and Kobayashi (1990) for dynamic SPR. Virgin CPUE estimate is 1948-52 mean; current CPUE estimate is a single year estimate. CPUE is of aggregate bottomfish calculated separately for Mau and Hoomalu Zones. Virgin catch size composition is estimated from the 1986-88 NWHI catch data, and current catch size composition is estimated from single year catch data. All SPR values changed slightly from previous year's reports due to improvements in the calculations. 90.25% non-parametric confidence intervals were constructed based on "best" and "worst" case bounds of SPR components (CPUE and percent immature).

ARMORHEAD STOCK ASSESSMENT

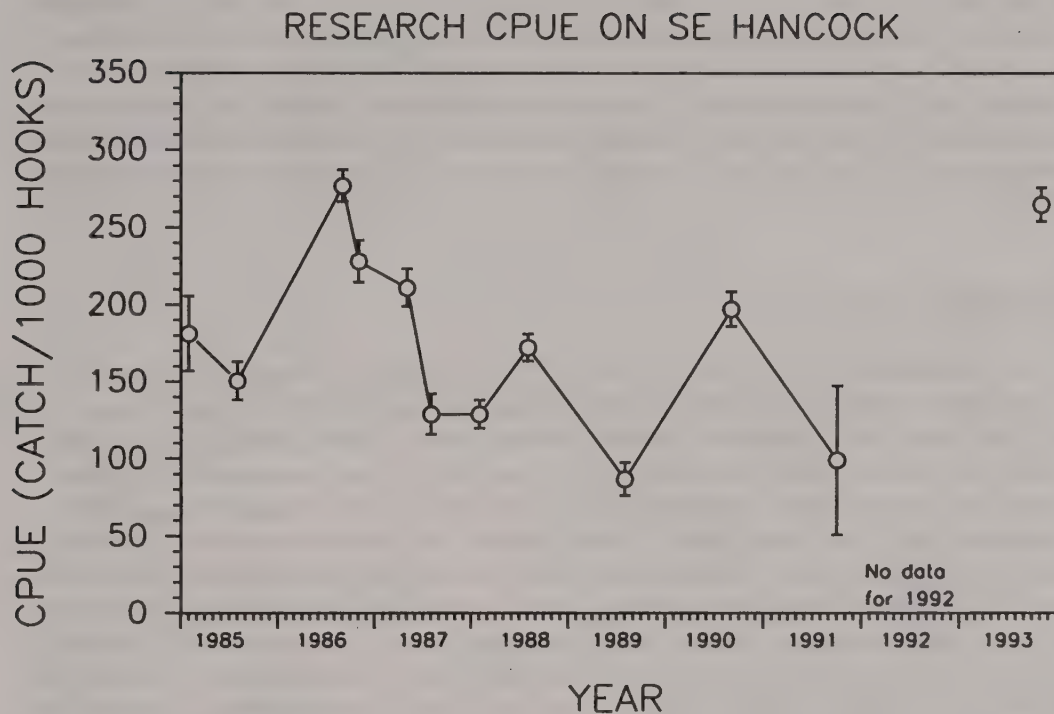


FIGURE H-18

DATA SOURCE:

Figure H-18 presents CPUE based on research longline catches at Southeast (SE) Hancock Seamount by NMFS, Honolulu personnel aboard NOAA ship R/V *Townsend Cromwell*. Vertical bars represent the 95% confidence intervals about the mean CPUE. The CPUE derived from the September 1991 stock assessment survey was computed using data from only the first 5 bottom longline sets as opposed to the standard 40 sets used on all other research surveys. The armorhead population at SE Hancock Seamount was not assessed in 1992 and post-1993 and therefore no current CPUE estimates are available. The last stock assessment survey for armorhead at SE Hancock Seamount was conducted in October 1993. Future NMFS armorhead stock assessment cruises to SE Hancock Seamount are unlikely. Henceforth, annual armorhead SPR values for Colahan Seamount (located outside the U.S. EEZ) will be provided to serve as a relative indicator of armorhead stock levels at the Hancock Seamounts (see explanation in Calculations & Adjustments subsection of ARMORHEAD SPAWNING POTENTIAL RATIO section).

CALCULATIONS & ADJUSTMENTS:

Fishing gear and sampling methods utilized during armorhead stock assessment surveys at SE Hancock Seamount are described in Somerton and Kikkawa (1992; Fishery Bulletin, U.S. 90:756-769). The seamount is divided into quadrants and effort is portioned equally among quadrants. Within each quadrant, effort is conducted over four depth strata (<265 meters (m), 265-300 m, 301-400 m, and 401-500 m). CPUE is calculated as a depth stratified average. Based on gear comparison studies of fishing droppers with and without hook timers conducted on the August 1990 survey, new coefficients accounting for the negative effects of hook timers were computed and applied to the catches obtained on all SE Hancock research surveys since 1985.

INTERPRETATION:

The fluctuations in CPUE shown in Figure H-18 are apparently the result of episodic recruitment followed by high natural mortality. These peaks in CPUE correspond to years (1986 and 1990) where an appreciable proportion (at least one-third) of the armorhead population consisted of fat individuals (fatness index ≥ 0.26) considered new recruits to the seamount population. Fatness index is defined as body depth divided by fork length. Subsequent to recruitment individuals cease somatic growth and over the course of 3-4 years, survivors decline in fatness index and weight. Without subsequent recruitment to the population in succeeding years, the armorhead population as a whole would decline both in numbers (natural mortality) and in biomass (natural mortality and declining fatness index of survivors). The high 1993 CPUE is unusual, however, since fat individuals (new recruits) account for <15% of the 1993 population while leaner individuals (<0.23 in fatness index) form the bulk of the population. These results apparently indicate that the 1993 population is primarily derived from recruitment which occurred either in late 1991 or during 1992. Previous work indicates that little if any annual recruitment to SE Hancock Seamount occurs after the summer months (Humphreys et al. 1993; Fishery Bulletin, U.S. 91:455-463). Since the 1991 stock assessment survey coincided with the end of the summer season, the increase in CPUE at SE Hancock for 1993 is most likely due to good recruitment during 1992. The sharp increase in the 1992 CPUE among seamounts outside the U.S. EEZ implies that a high recruitment occurred (across all seamounts) in 1992.

TABULATED VALUES:

MONTH/YEAR	ARMORHEAD CPUE
JAN 1985	181.28
JUN 1985	150.51
AUG 1986	276.80
OCT 1986	228.03
APR 1987	210.98
AUG 1987	128.73
JAN 1988	128.77
JUL 1988	172.14
JUL 1989	86.69
AUG 1990	197.08
SEP 1991	98.97
1992	(unknown)
OCT 1993	264.85
1994	(unknown)
1995	(unknown)
1996	(unknown)
1997	(unknown)
1998	(unknown)
1999	(unknown)
2000	(unknown)
2001	(unknown)
2002	(unknown)

ARMORHEAD SPAWNING POTENTIAL RATIO

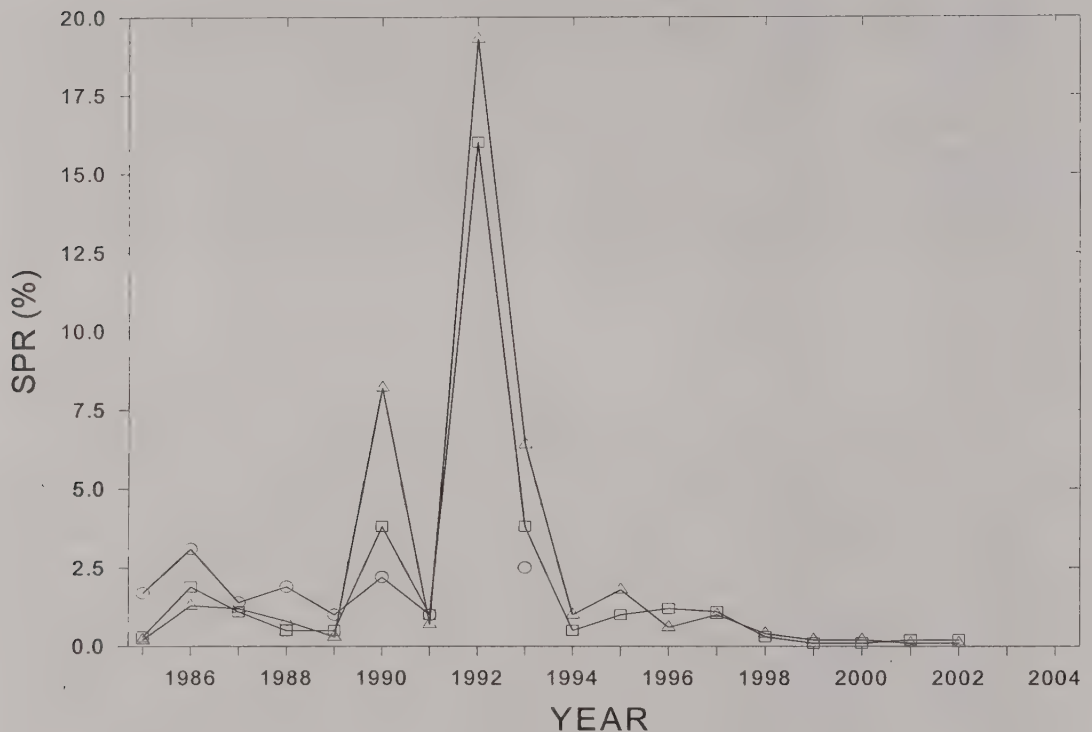


FIGURE H-19

DATA SOURCE:

SPR values for seamounts outside the U.S. EEZ are based on reported catch and effort data from the Japanese trawler fleet and values for seamounts within the U.S. EEZ (Hancock Seamounts) are based on research longline CPUE in addition to the trawl CPUE. However, with the cessation of research longline cruises to the Hancock Seamounts, SPR values for Colahan Seamount (comparable in size and located closest to the Hancocks among seamounts outside the U.S. EEZ) are being provided now and in the future as an indicator of stock levels at the Hancock Seamounts. SPR values for Colahan Seamount are also based on reported catch and effort data at that seamount by the Japanese trawler fleet.

CALCULATIONS & ADJUSTMENTS:

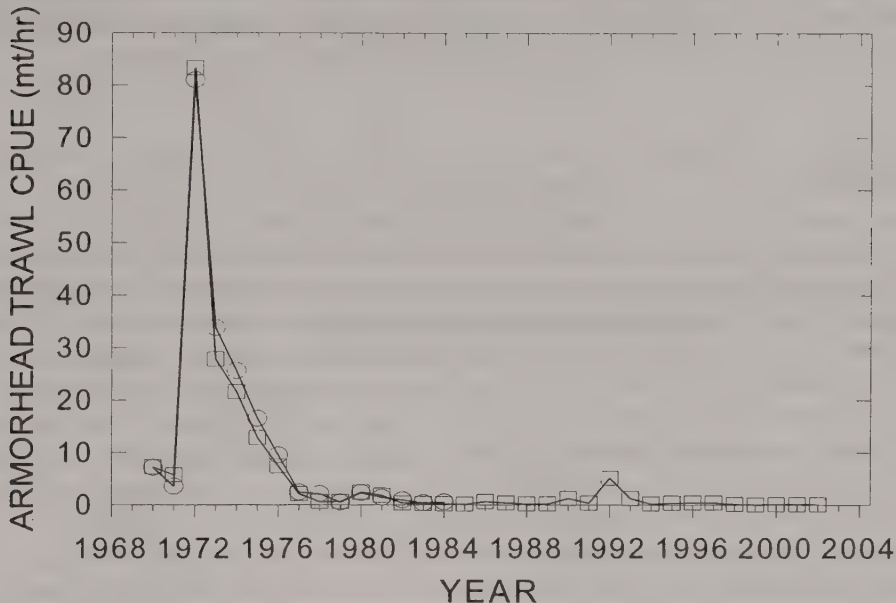


FIGURE H-20

SPR values outside the U.S. EEZ are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972). SPR values inside the U.S. EEZ are computed as the estimated biomass on SE Hancock Seamount divided by the 1970-1972 average biomass. Biomass estimates are based on procedures described in Somerton and Kikkawa (1992). The SPR values for Colahan Seamount are computed as the current year CPUE divided by the average CPUE during the first three years of the fishery (1970-1972) at Colahan Seamount (Figure H-19). Fishery catch and effort data by seamount by month for seamounts outside the U.S. EEZ have been provided annually since 1980 by colleagues at the National Research Institute for Far Seas Fisheries in Shimizu, Japan.

The decision to use SPR values for Colahan Seamount (instead of the overall outside U.S. EEZ values) as an indicator of armorhead stock conditions inside the U.S. EEZ (i.e., Hancock Seamounts) is based on the greater similarities between these seamounts. Aside from Colahan Seamount, the seamounts fished for armorhead outside the U.S. EEZ are Milwaukee Seamounts and Koko Seamount. These latter seamounts have summit areas of 67 and 564 nm² and average summit depths of 190 and 170 fm, respectively, while Colahan and the Hancock Seamounts have much smaller summit areas (about 1.4 nm²) and shallower summit depths (141-150 fm). Fishing effort by the Japan trawl fleet has historically been different at these two types of seamounts. Koko and Milwaukee Seamounts have always received the majority (about two-thirds) of the annual total trawling effort and were typically fished intensively over a sustained period of time. However, the fishing effort at Colahan and the Hancock Seamounts was applied in pulses since catch levels could not be sustained for more

than several days without a "cooling off" period. These similarities plus the historical close coincidence between Colahan and Hancock Seamounts in temporal profiles of armorhead CPUE from the Japan trawl fleet (Figure H-20) indicate that SPR values for Colahan Seamount should provide the best future indicator of armorhead stock levels at the Hancock Seamounts.

INTERPRETATION:

Seamounts outside the U.S. EEZ represent some 91% of the historical trawl fishery in term of fishing grounds and overall catch and lie in international waters under no fishery management control. The most current SPR estimate for armorhead within the region outside the U.S. EEZ is 1.0%; based on the most current (1997) available catch and effort statistics from the Japan North Pacific trawl fishery. The 1996 SPR of 0.4% in last year's report was incorrect; the correct value (0.6%) however was only slightly higher. These low SPR values for the last two years of data indicate a continued depression in stock levels since the dramatic increase of SPR levels outside the U.S. EEZ in 1992 and the equally dramatic decline and continued low levels since then. This continuation of low stock levels outside the U.S. EEZ is interpreted to be a result of the intensive fishing effort on the high 1992 recruitment pulse coupled with little subsequent recruitment during 1993-1997 to compensate for losses due to fishing and natural mortality. Based on previous trends, catch levels are expected to remain low in unless offset by a large recruitment event.

Based on age estimates of a 2-2.5 year pelagic phase prior to seamount recruitment (Humphreys 2000), the 1992 recruitment would have originated from the 1989-1990 winter spawning season. If this is correct, then the large 1992 recruitment originated from a parental stock which in 1989 had one of the lowest SPR values both inside and outside the U.S. EEZ (see table next page). This would appear to support the notion that dramatic increases in armorhead abundance across the seamounts are episodic and the product of environmental factors rather than simply a stock-recruitment relationship.

During February-March 1997, an oceanographic and larval armorhead survey over the seamounts outside the U.S. EEZ was conducted onboard the R/V *Kaiyo Maru* by the National Research Institute of Far Seas Fisheries Laboratory in Shimizu, Japan. Initial plans were to include research trawl hauls over Colahan Seamount, however, the ship was no longer equipped to conduct bottom trawl operations. Armorhead larvae were collected from surface waters around the Milwaukee Seamounts group, Colahan and C-H Seamount, but were absent from Koko Seamount. This same vessel conducted a research survey of pelagic stage armorhead in open ocean waters of the North Pacific during November 1998. The major objective was to tag-and-release pelagic specimens from various locations distant from the seamounts in hopes of later obtaining seamount re-captures and movement data. Unfortunately, no pelagic stages of armorhead were encountered during this cruise.

Four the previous four years, NMFS had been unable to obtain more recent data (1998 to present) from the Japan seamount trawl fleet. The fisheries agency that had been providing us

data was no longer authorized to disseminate this data to our laboratory. However, this agency has just this year been able to forge an inter-government (within Japan) agreement that has now allowed the resumption of this data flow to NMFS.

MANAGEMENT ISSUES:

Effective September 1, 1998, the fishing moratorium on seamount groundfish at the Hancock Seamounts was extended for a third 6-year period until August 31, 2004. Based on current sustained low SPR values both at Colahan Seamount and at all SE-NHR seamounts outside the U.S. EEZ, it was inferred that the status of the Hancock Seamounts armorhead resource was similarly depressed. The intent of the moratorium is to provide continued long-term protection (which is absent elsewhere within the much larger seamount habitat of the SE-NHR) to enhance the possibility of armorhead and other seamount groundfish resources to re-build via recruitment.

TABULATED VALUES:

ARMORHEAD SPR (%)

YEAR	INSIDE US EEZ	COLAHAN	OUTSIDE US EEZ
1985	1.7	0.3	0.2
1986	3.1	1.9	1.3
1987	1.4	1.1	1.2
1988	1.9	0.5	0.8
1989	1.0	0.5	0.3
1990	2.2	3.8	8.2
1991	1.0	1.0	0.7
1992	NA	16.0	19.3
1993	2.5	3.8	6.4
1994	NA	0.5	1.0
1995	NA	1.0	1.8
1996	NA	1.2	0.6
1997	NA	1.1	1.0
1998	NA	0.3	0.4
1999	NA	0.1	0.2
2000	NA	0.1	0.2
2001	NA	0.2	0.1
2002	NA	0.2	0.1

Appendix 4

Commonwealth of the Northern Mariana Islands

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Summary

Landings of bottomfish decreased (34.3% fewer pounds in 2002 than in 2001) from the highest total landings last year, to slightly higher than the 20-yr mean. Bottomfish landings in the CNMI have been higher than the 20-yr mean for the last 7 years. The number of trips during which bottomfishes were caught also decreased to near the 20-yr mean, and the average bottomfish catch per trip increased to just above the 20-yr mean. This fishery continues to show a high turnover with changes in the high liners participating in the fishery and an increased number of local fishermen focusing on reef fishes in preference to bottomfishes. Fishermen are moving towards an increasing number of multi-purpose trips that focus primarily on reef fishes and catch pelagic species while in transit. In doing so, the shallow-water bottomfish complex continues to be exploited, but as part of the exploitation of reefs near the populated islands. Redgill emperor (mafute') is the most frequently harvested and easily identified species in this complex, although a variety of snappers and groupers are also harvested.

The number of large-vessel commercial bottom-fishing ventures active in the northern islands appeared to increase to eight during 2000, but only four were active for more than a few trips. Of these four, two primarily sold their catches off the island of Saipan (mostly to the large hotels in Tinian). Commercial trips made by these large vessels are no longer sampled on a monthly basis. These vessels catch the majority of the deep-water bottomfishes, although in 2002 one high liner for onaga used small vessels to fish locally off Saipan. In 2002, the most consistent high liner of previous years did not fish, and a second high liner only fished the first 5 months of 200.

Domestic US, joint-venture, and foreign vessels continue to inquire about full-time bottom fishing throughout much of the CNMI. The impact of these ventures on the commercial market is still unclear despite a fish-market assessment study conducted in 1994, and completed in late 1996. The results of this study did not correspond with the significant increase in the northern islands bottomfish harvest.

Revenues and prices for bottomfishes were lower in 2002 than in 2001, with the inflation-adjusted revenue greater than the 20-year mean, but the average price per pound (adjusted) continued to be lower than the 20-yr mean. Only 5 years in the last 20 have had lower values. Prices decreased for all groups (from 10¢ to 79¢ /lb) from last year, with the exception of ehu (increased 4¢ /lb), gindai (increased 5¢ /lb), sickle pomfret (increased 18¢ /lb), and "assorted bottomfish" (increased 2¢ /lb). Onaga still command the best prices, but the range is narrowing with opakapaka, blueline snapper, gindai, ehu, kalikali, emperor (mafute'), and silvermouth within 50¢ per pound.

Over the last 6 years, 64% of mafute fishermen and 62% of onaga fishermen making commercial sales participated for only a single year and no fishermen participated in all 6 years (regardless of how small the sales). Fishermen utilizing larger vessels have greater access to the deep-water bottomfish resources, especially in the northern islands of the CNMI. However, this sector of the industry requires more investment, consistent long-term effort, and knowledge to recoup the costs than the shallow-water bottomfish sector. This industry could continue to expand with support from a training program in bottomfishing that addresses the following: proper fish handling and maintenance of product quality, use of fathometers, nautical charts, modern electronic equipment such as GPS, fish finders, electric reels, anchoring techniques, marketing, and financial planning. Moreover, side-band sonar mapping of the banks used by commercial fishermen from Farallon de Medinilla to Rota should assist the growth of this sector.

Historical Annual Statistics for CNMI Bottomfishes

year	total landings (lbs)	CPUE (lb/trip)	inflation-adjusted revenue (\$)	average price (per lb)	number of boats
1983	28,529	53	97,054	3.40	90
1984	42,664	87	131,267	3.08	102
1985	40,975	145	117,717	2.87	55
1986	29,912	131	93,539	3.13	54
1987	49,715	210	142,838	2.87	43
1988	47,313	224	130,336	2.75	29
1989	24,438	95	73,965	3.03	29
1990	13,628	106	44,748	3.28	29
1991	7,116	57	25,385	3.57	20
1992	10,598	74	31,144	2.94	37
1993	18,461	104	52,235	2.83	20
1994	25,470	92	76,905	3.02	32
1995	36,102	116	128,992	3.57	34
1996	66,362	148	230,123	3.47	70
1997	64,090	170	216,833	3.38	69
1998	59,040	185	206,157	3.49	50
1999	56,201	196	205,158	3.65	51
2000	45,619	72	128,488	2.82	66
2001	71,660	86	219,183	3.06	75
2002	47,110	126	135,823	2.88	53
mean	39,250	124	124,394	3.15	50
standard deviation	19,107	51	64,522	0.29	23

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Introduction

The Commonwealth of the Northern Mariana Islands' (CNMI) bottomfish fishery occurs primarily around the islands and banks from Rota Island to Zealandia Bank north of Sarigan. However, the data are limited to the catches landed on Saipan, which is by far the largest market. For this reason, Mr. David Hamm strongly recommended that these landings (in pounds) and revenues be inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market). The results presented in this report do so. The fishery is characterized in this report by data collected through the Commercial Purchase Database, which indirectly records actual landings by recording all local fish sales to commercial establishments. This data collection system is dependent upon voluntary participation by first-level purchasers of local fresh fish to accurately record all fish purchases by species categories on specially designed invoices. Division of Fish and Wildlife (DFW) staff routinely collected and distributed invoice books to 34 participating local fish purchasers in 2002; which include the majority of the fish markets, stores, restaurants, hotels, government agencies, and roadside vendors (fish-mobiles). This is a marked reduction from 42 participants last year, because many vendors are no longer open.

Although this data collection system has been in operation since the mid-1970s, only data collected since 1983 are considered accurate enough to be comparable for most aspects of the fishery. The identification and categorization of fishes on the sales invoices has improved markedly in the last 10 years. Unfortunately, two inherent problems remain in the database. First, a number of the bottomfish MUS are not listed on the sales receipts. This was partially corrected by the addition of new taxa (but not all BMUS species) to the receipts (black jack, giant trevally, amberjack, ehu, blueline snapper, kalikali, and sickle pomfret were added to sales invoices in 2001). However, not all vendors are using the new receipts. Moreover, for those BMUS species not specifically listed on the receipts there remains some confusion regarding where they should be added to the receipts. Second, the market is changing, with more fishermen pooling their catches and sales often representing more than a single one-day trip by a single fisherman.

The CNMI's bottomfishery still consists primarily of small-scale local boats engaged in commercial and subsistence fishing, although a few (generally <5) larger vessels (35–60 ft) usually participate in the fishery. The bottomfishery can be broken down into two sectors: deep-water (>500 ft) and shallow-water (100–500 ft) fisheries. The deep-water fishery is primarily commercial, targeting snappers and groupers. The snappers targeted include members of *Etelis* and *Pristipomoides*, whereas the eight-band grouper (*Epinephelus octofasciatus*) is the only targeted grouper. The shallow-water fishery, which targets the redgill emperor (*Lethrinus rubrioperculatus*), is mostly commercial but also includes subsistence fishermen. These fishermen are taking not only bottomfishes, but many reef fishes (especially snappers and groupers) as well. Hand lines, home-fabricated hand reels and electric reels are the common gear used for small-scale fishing operations, whereas electric reels and hydraulics are the common gear used for the larger operations in this fishery. Historically, some trips have lasted for more than a day, but currently, effort is defined and calculated on a daily trip basis. Fishing trips are often restricted to daylight hours, with vessels presumed to return before or soon after sunset, unless fishing in the northern islands. In terms of participation, the bottomfish fleet consists primarily of vessels less than 24 ft long that are usually limited to a 30-mi radius from Saipan. The larger commercial vessels that are able to fish extended trips and which focus their effort from Esmeralda Bank to Zealandia Bank are presumed to have landed the majority of the deep-water bottomfish reported through the purchase receipt forms. In 2002, the most consistent high liner of previous years did not fish and a second high liner only fished the first 5 months of 2002.

Bottomfishing requires more technical skill than pelagic trolling, including knowledge of the location of specific bathymetric features. Presently, bottomfishing can still be described as “hit or miss” for most of the smaller size (14–25 ft) vessels. Without fathometers or nautical charts, the majority of fishermen utilizing smaller vessels often rely on land features for guidance to a fishing area. This type of fishing is inefficient and usually results in a lower catch-per-unit-effort (CPUE) in comparison with pelagic trolling. These fishermen tend to make multi-purpose trips—trolling on their way to reefs where they fish for shallow-water bottomfish and reef fish. Larger sized (25-ft and larger) vessels typically utilize Global Positioning System (GPS), fathometers, and electric reels, resulting in a more efficient operation. In addition, reef fishes are now commanding a consistently higher price than in previous years. This appears to be reflected in an increased number of fishermen using small vessels focusing on reef and/or pelagic species over bottomfishes.

The participation of fishermen in the bottomfishery tends to be very short term. During the past 6 years, 64% of the mafute' fishermen and 62% of the onaga fishermen only sold fishes for a single year, and none sold fishes in all 6 years. Among high liners selling more than 500 lbs/yr, 67% of both the mafute' and onaga fishermen only made large sales in a single year, and none made sales >500 lbs/yr in more than 3 of the 6 years. Whereas tenacity of mafute' fishermen in the bottom fishery drops with each year (64% participate for 1 yr, 20% for 2 yrs, 10% for 3 yrs, 6% for 4 yrs, and 1% for 5 yrs), the tenacity of onaga fishermen is higher for 3 yrs of participation than for 2 yrs (62% participated for 1 yr, 10% for 2 yrs, 20% for 3 yrs, 6% for 4 yrs, and 2% for 5 yrs). This likely reflects the greater skill and investment required to participate in the deep-water bottomfishery. In addition, these tend to be larger ventures that are more buffered from the vagaries of an individual's choices and are usually dependent on a skilled captain/fisherman. Overall, the long-term commitment to hard work, maintenance and repairs, and staff retention appear to be difficult, if not impossible for CNMI bottomfishermen to sustain more than a few years.

Recommendations

2002 Recommendations

- 1) To request NMFS and the Council continue to assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.
- 2) To request NMFS and the Council continue to assist the CNMI by supporting the MARAMP cruises to the northern islands of the CNMI.
- 3) To request the council to hire a consultant to examine and assess the best way to capture the data necessary for fishery management (potentially through creel surveys, community development programs, commercial purchase systems, or other types of data collection systems), while including the local social, political, legal, and economic constraints within the CNMI.

2001 Recommendations & Progress

- 1) To request NMFS and the Council to assist DFW in identifying an expert who is capable of and willing to prepare otoliths of redgill emperor and then count daily growth rings.

This recommendation was removed from this list, because DFW identified an expert who was willing to and capable of preparing the otoliths of redgill emperor at the ORC Reef Research Center in Townsville, Australia.

- 2) To request NMFS and the Council assist the CNMI by contracting a specialist to map commercial fishing banks, particularly around Farallon de Medinilla, Marpi Reef, and the banks closest to Saipan, Tinian, and Rota.

This recommendation remains a high priority for the CNMI, and has been continued as a recommendation for 2002.

- 3) To request that Council merge the Bottomfish Plan Team (as well as the Crustacean Plan Team) with the Coral Reef Ecosystem Plan Team.

No action was taken.

Figures, Interpretations, Calculations, and Tables

Table 1.—CNMI consumer price indices (CPIs).

<u>year</u>	<u>CPI</u>	<u>CPI adjustment factor</u>
1983	140.90	1.93
1984	153.20	1.77
1985	159.30	1.70
1986	163.50	1.66
1987	170.70	1.59
1988	179.60	1.51
1989	190.20	1.43
1990	199.33	1.36
1991	214.93	1.26
1992	232.90	1.17
1993	243.18	1.12
1994	250.00	1.09
1995	254.48	1.07
1996	261.98	1.04
1997	264.95	1.02
1998	264.18	1.03
1999	267.80	1.01
2000	273.23	0.99
2001	270.98	1.00
2002	271.53	1.00

Calculation: The Commonwealth of the Northern Mariana Islands' Consumer Price Index is computed by the CNMI Department of Commerce using the Laspeyres' formula. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Figure 1.—Commercial bottomfish landings, allocated to sector of the fishery (or categorized as “assorted bottomfishes”).

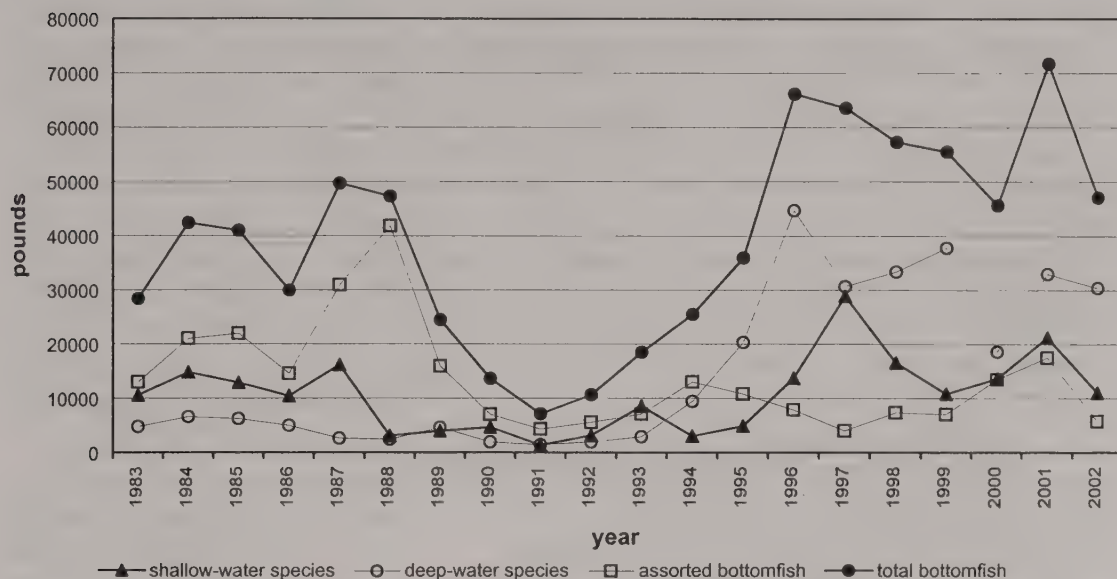


Figure 2.—Commercial bottomfish landings of shallow-water species.

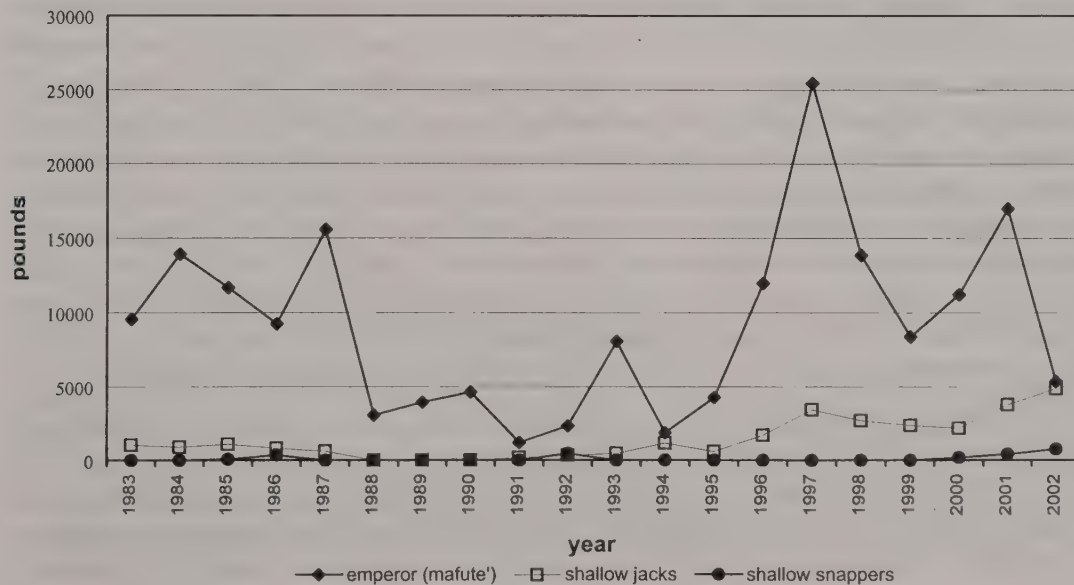
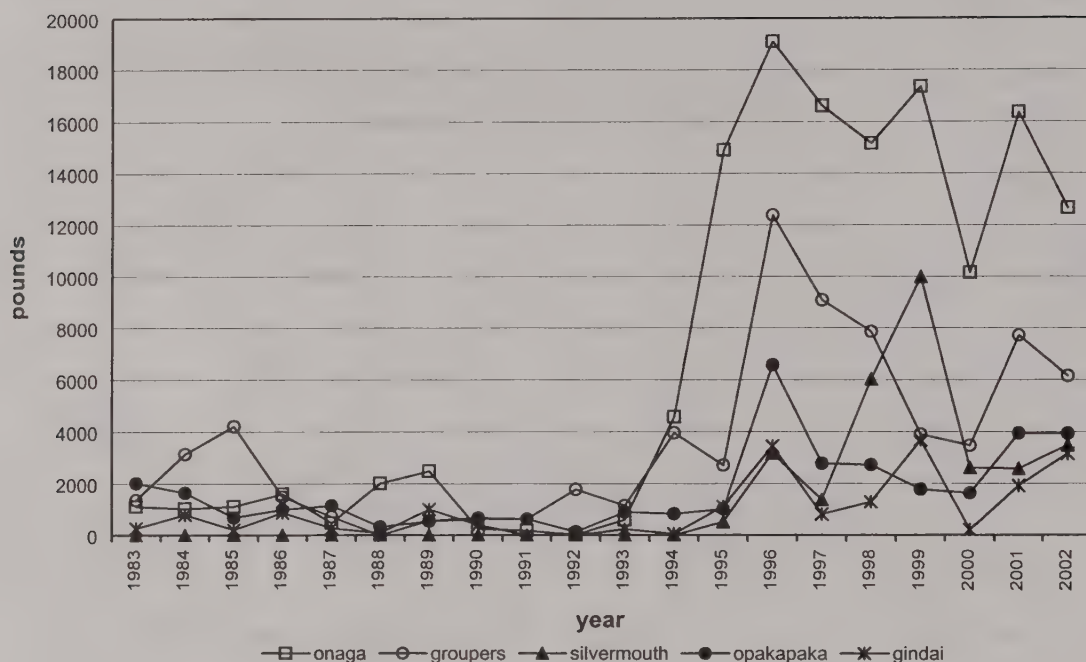


Figure 3.—Commercial bottomfish landings of deep-water species.



Interpretation: Taken as a whole, the number of pounds of bottomfishes sold (landings) decreased in 2002 by 34% from that of 2001. In part, this may be explained by a large number of days in 2002 where the sea conditions were too rough for small vessels (including the passage of super-typhoons Chataan and Pongsona). In addition, fewer fishermen are landing bottomfishes in the CNMI. Only 53 fishermen sold bottomfishes as part of their catch in 2002, compared to 75, 66, 51, 50, and 69 in each of the previous 5 years.

Bottomfishes that were categorized simply as “assorted bottomfish” were the largest portion of the landings until 1995. Since 1995, deep-water bottomfishes have been the largest portion of the catch, with shallow-water bottomfishes becoming the second largest portion of the catch in 1996, and remaining there through 2002. The slight rise in landings of “assorted bottomfish” in 2000 and 2001 probably reflects a change in staff at DFW. In 2002, “assorted bottomfishes” decreased to 12.1% of the landings (or 1.26% of the bottomfish records). This probably reflects the use of the new sales invoice forms, with more species specifically listed and increased efforts on the part of staff to encourage buyers to list purchases as exactly as possible. The use of the category “assorted bottomfish” will likely continue, because the diversity of the catch is great and many buyers sell these species as “assorted bottomfish,” so there is little perceived need to identify them more completely.

The number of pounds of shallow-water bottomfishes commercially sold (landings) appeared to peak between 1996 and 2001. It is likely that there was a comparable peak in landings between 1984 and 1987, but this result is difficult to discern because of the large number of bottomfishes that were categorized as “assorted bottomfish” during the earlier period. The landings of emperor (mafute' of the family Lethrinidae) have experienced large fluctuations over the last 20 years, and particularly over the last 8 years. In 2002, the number

of pounds of mafute' commercially sold fell below the 20-year mean to the lowest level since 1995. This is likely the result of turnover in this sector of the industry (64% of the mafute' fishermen made sales [of any size] in only 1 of the last 6 years) and the ⅓ reduction in the number of fishermen selling mafute' (22 in 2002 compared to 36 in 2001, 32 in 2000, 1999, and 1998, and 46 in 1997). The landings of jacks fished in shallow areas (itemized as “jacks,” amberjack [*Seriola dumerili*], giant trevally [*Caranx ignobilis*], and black jack [*C. lugubris*] on the sales invoices) appears to have slowly increased over the last 10 years, with the highest landings reported in 2002. This is likely related to the decrease in the amount of the landings sold as “assorted bottomfish,” but may also partially reflect an actual increase in landings of shallow-water jacks given that “jacks” have been specifically reported for most of the last 20 years. The category “jacks” may include any carangids sold, including BMUS species *Carangoides orthogrammus*, *Caranx melampygus*, *C. papuensis*, and *C. sexfasciatus*. Landings of amberjack were slightly higher in 2002 than the 20-year mean. Giant trevally and black jack were reported in 2002 for the first time, likely as a result of being added to the new sales invoice. Jobfish (*Aprion virescens*) have been reported in 7 of the last 20 years, and in 2002 landings were higher than the 7-year mean. Landings of blueline snapper (*Lutjanus kasmira*) and humpback snapper (*Lutjanus gibbus*) were reported for the first time in 2002.

Deep-water bottomfish landings increased significantly in 1995 and have remained fairly high since then. This is likely the result of an increase in the number of large vessels participating in the deep-water bottomfishery that are capable of fishing the islands and banks north of Farallon de Medinilla. Note however, that deep-water bottomfishes are still caught in large numbers near Saipan. For example in 2002, 1 of the 3 onaga high liners (landing >1600 lbs of onaga) fished locally around Saipan. The landings of onaga (*Etelis coruscans* and some *Etelis radiosus*) fell again in 2002, but are still almost twice the 20-year mean. Note that this sector of the industry also has a high turnover, (62% of the onaga fishermen made sales [of any size] in only 1 of the last 6 years), but differs from the mafute' in that successful fishermen often participate for more years (10% of the onaga fishermen made sales [of any size] in 2 of the last 6 years, but 20% of these fishermen made sales in 3 of the last 6 years). This sector of the fishery has remained nearly constant at 10–15 fishermen for 5 of the last 6 years; but in 2001, 22 fishermen made sales of onaga. The landings of groupers (primarily *Epinephelus octofasciatus*, but almost certainly including shallow-water species such as *Variola louti* and *E. fasciatus*) have varied widely over the last 8 years, with a 20.3% decrease in landings in 2002 from 2001 but still remain over the 20-year mean. Silvermouth (*Aphareus rutilans*) have been reported since 1995, and landings have fluctuated considerably. Landings in 2002 were 34.6% higher in 2002 than 2001, but slightly lower than the 8-year mean. Opakapaka (*Pristipomoides filamentosus*, and likely some *P. flavipinnis*) landings have varied somewhat in the last 8 years, but the 2002 landings were indistinguishable from those of 2001 and remain more than twice the 20-year mean. Gindai (*Pristipomoides zonatus*, and likely some *P. argyrogrammicus*) landings have also varied over the last 8 years, with this year's landings 64.8% greater than last year's. The landings of gindai in 2001 were almost 3 times the 18-year mean. Reported landings of ehu (*Etelis carbunculus*) were more than 3000% greater than the landings in 2001, but essentially the same as the 5-year mean. The increase reported in 2002 likely is a result of the addition of this species category to the new sales invoice. Landings of sickle pomfret (*Taractichthys steindachneri*) have been reported the last 4 years, with a 14.8% decrease from those of 2001, but remain just slightly below the 4-year mean. This species was also added to the new sales invoice this year. Kalikali (*Pristipomoides auricilla* and *P. sieboldii*) were reported in 1998, 1999, and 2002, although they appeared on the new sales invoice for the first time in 2002.

Calculation: Annual summaries for each species from sales invoice datasheets are totaled and then inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002).

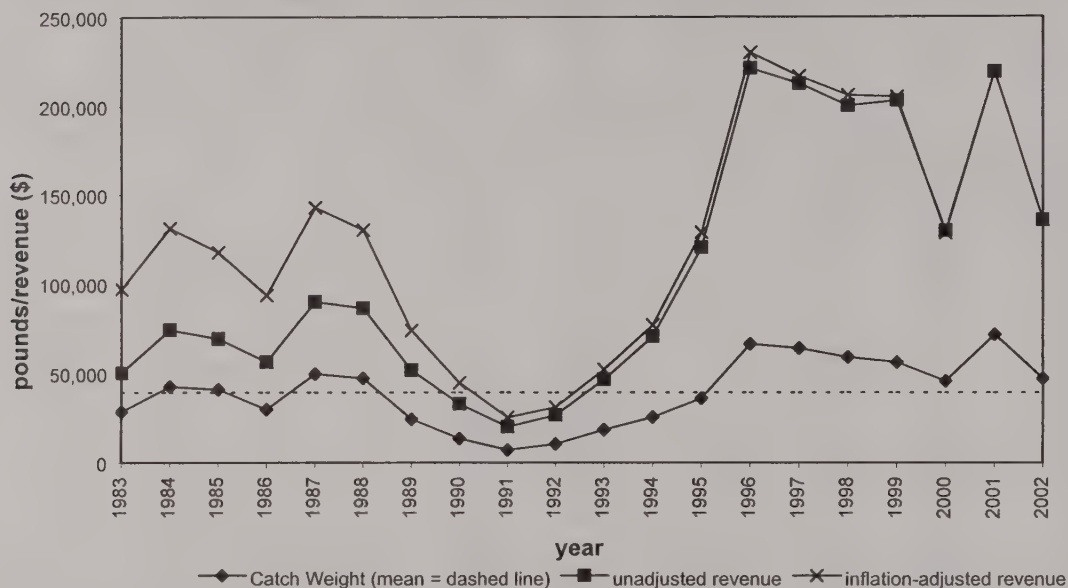
Table 2.—Commercial landings (in pounds) of shallow-water bottomfishes.

year	emperor (maifute ¹)	jacks	amberjack	giant trevally	black jack	jobfish	blueline snapper	humpback snapper	assorted bottomfish
1983	9555	1031							12998
1984	13925	906							20971
1985	11676	962	135			81			21904
1986	9250	818				363			14528
1987	15568	607							30929
1988	3078								41823
1989	3963								15891
1990	4648								7030
1991	1211	175							4296
1992	2338	337				450			5543
1993	8083	454							7055
1994	1870	1169				16			13002
1995	4276	596							10778
1996	11990	1697							7846
1997	25444	3447							3998
1998	13853	2380	317						7351
1999	8396	2019	343						7004
2000	11223	2142	28			190			13451
2001	16987	3761	21			425			17485
2002	5364	4584	184	48	52	389	352	29	5718
mean	9135	1593	171	48	52	274	352	29	13480
standard deviation	6148	1299	138			176			9617

Table 3.—Commercial landings (in pounds) of deep-water bottomfishes.

year	onaga	groupers	silvermouth	opakapaka	gindai	ehu	sickle pomfret	kalikali	alfonsin
1983	1118	1363		2022	267				
1984	1026	3141		1639	798				
1985	1117	4210		681	208				
1986	1598	1494		987	874				
1987	472	721		1146	271				
1988	2001			326	85				
1989	2478	563		538	1006				
1990	253	678		628	393				
1991	175	629		629					
1992	21	1773		136					
1993	593	1146		898	232				
1994	4578	3953		824	58				
1995	14910	2715	521	1019	1114				
1996	19093	12383	3179	6570	3452				
1997	16613	9086	1375	2780	821				
1998	15158	7864	6028	2729	1295	197		124	
1999	17351	3901	9986	1772	3686	821	233	6	
2000	10159	3474	2614	1633	214	45	446		
2001	16358	7719	2585	3951	1916	8	404		40
2002	12655	6149	3479	3932	3157	263	344	410	
mean	6886	3840	3721	1742	1103	267	357	180	40
standard deviation	7306	3359	3004	1586	1181	327	93	208	

Figure 4.—Commercial bottomfish landings and revenue.



Interpretation: Landings, revenues, and adjusted revenues for 2002 all fell significantly to nearer the 20-year mean. Although the landings, revenues, and adjusted revenues for bottomfishes has been comparatively high for the last 7 years compared to the preceding 13 years, there have been considerable changes in the composition of the fishery during the last 7 years. Prices for bottomfishes have also decreased over the past few years. Local buyers seem to increasingly prefer reef fishes and they are commanding higher prices each year.

The number of fishermen selling mafute' (as representative of the shallow-water bottomfish sector) fell to 22 in 2002, a marked decrease from the previous 5 years (36 in 2001, 32 in 2000, 32 in 1999, 32 in 1998, and 46 in 1997). In each of these years, 1 to 4 fishermen have landed >1000 lbs (4 to 6 have landed more than 500 pounds), but no one has been a high liner in more than 3 years. Many of the fishermen catching mafute' do so locally, but appear to be increasing their focus on reef fishes. The bottomfishes are a smaller portion of their sales and seem to be co-lateral catch (i.e., if caught in sufficient numbers while focusing on other species, then they too will be sold).

The number of fishermen selling onaga (as representative of the deepwater bottomfish sector) has remained relatively constant from 1997 to 2000 (10, 14, 13, and 15 respectively). In 2001, 22 fishermen made at least 1 sale of onaga. This year, 12 fishermen sold onaga. In each of the years 1997–2000, 2 or 3 fishermen landed >1000 lbs (3 or 4 landed >500 lbs). In 2001, 5 fishermen landed >1000 lbs (and 6 landed >500 lbs). This year, only 2 fishermen landed >1000 lbs and 3 landed >500 lbs. No single fisherman was a high liner every year and only 2 sold >750 lbs in 3 of the last 6 years. Vessels capable of landing large amounts of onaga are usually larger vessels fishing the northern islands. The difficulty of maintaining the equipment, vessel, and crew to consistently and routinely make these trips successful appears to be difficult in the long term for fishermen in the CNMI.

Revenues and prices for bottomfishes were less in 2002 than in 2001, with the average price per pound (adjusted) lower than the 20-yr mean. Only 5 years in the last 20 have lower values. Prices decreased for all groups (from 10¢ to 79¢ /lb) from last year, with the exception of ehu (increased 4¢ /lb), gindai (increased 5¢ /lb) sickle pomfret (increased 18¢ /lb), and “assorted bottomfish” (increased 2¢ /lb). Onaga still command the best prices, but the range is narrowing, with opakapaka, blueline snapper, gindai, ehu, kalikali, emperor (mafute'), and silvermouth within 50¢ per pound. Most fishes are sold as whole fish (and very few as filets or steaks). The larger species are often purchased by the hotel restaurants, which are now seeing far fewer customers and often importing fishes from outside the CNMI. In addition, the local public appears to show a greater demand for reef fishes. This may be reflected in the high price commanded by reef fishes such as parrotfishes (\$3.04/lb) and rabbitfishes (\$3.28/lb).

Calculation: Landings in pounds are from a simple database summation of reported purchases of each species of bottomfish. Total bottomfish landings sum across all bottomfish species. Revenue in dollars is from a simple summation of the value field. The landings and revenues values listed are inflated by 20% to represent the CNMI as a whole (assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002). The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

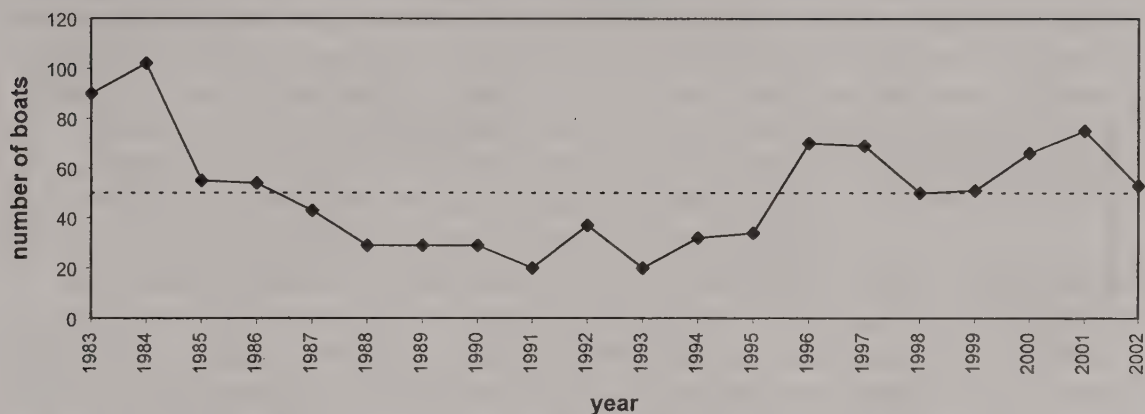
Table 4.—Commercial landings of and revenue for bottomfishes for 2002.

species	landings (lb)	revenue (\$)	average price (\$/lb)
jacks	4,584	10,067	2.20
giant trevally	48	89	1.85
black jack	52	138	2.66
amberjack	184	491	2.66
grouper	6,149	13,595	2.21
emperor (mafute')	5,364	15,577	2.90
silvermouth	3,479	10,103	2.90
jobfish	389	908	2.33
onaga	12,655	42,876	3.39
ehu	263	798	3.04
blueline snapper	352	1,101	3.13
humpback snapper	29	73	2.50
gindai	3,157	9,630	3.05
opakapaka	3,932	12,965	3.30
kalikali	410	1,214	2.96
sickle pomfret	344	676	1.96
assorted bottomfish	5,718	15,524	2.72
total	47,110	135,823	2.88

Table 5.—Commercial landings of and revenue for bottomfishes.

year	pounds	unadjusted revenue	inflation-adjusted revenue
1983	28,529	50,287	97,054
1984	42,664	74,162	131,267
1985	40,975	69,245	117,717
1986	29,912	56,349	93,539
1987	49,715	89,835	142,838
1988	47,313	86,315	130,336
1989	24,438	51,724	73,965
1990	13,628	32,903	44,748
1991	7,116	20,147	25,385
1992	10,598	26,619	31,144
1993	18,461	46,638	52,235
1994	25,470	70,555	76,905
1995	36,102	120,553	128,992
1996	66,362	221,272	230,123
1997	64,090	212,581	216,833
1998	59,040	200,152	206,157
1999	56,201	203,127	205,158
2000	45,619	129,786	128,488
2001	71,660	219,183	219,183
2002	47,110	135,823	135,823
mean	39,250	105,863	124,395
standard deviation	19,107	69,867	64,522

Figure 5.—Number of fishermen (boats) making bottomfish landings.



Interpretation: The number of fishermen (used as a proxy for the number of boats) making commercial landings of any bottomfish species has varied widely over the last 20 years and fell in 2002 to near the 20-year mean.

Calculation: The purchasers identify the fisherman or boats selling the catch on the sales invoices used when they purchase fishes from the fishermen. The plot shows the number of unique fishermen selling their catch of bottomfish within a given year.

Table 6.—Number of fishermen (used as a proxy for number of boats) making commercial landings of bottomfishes.

year	boats
1983	90
1984	102
1985	55
1986	54
1987	43
1988	29
1989	29
1990	29
1991	20
1992	37
1993	20
1994	32
1995	34
1996	70
1997	69
1998	50
1999	51
2000	66
2001	75
2002	53
mean	50
standard deviation	23

Figure 6.—Number of bottomfish trips.

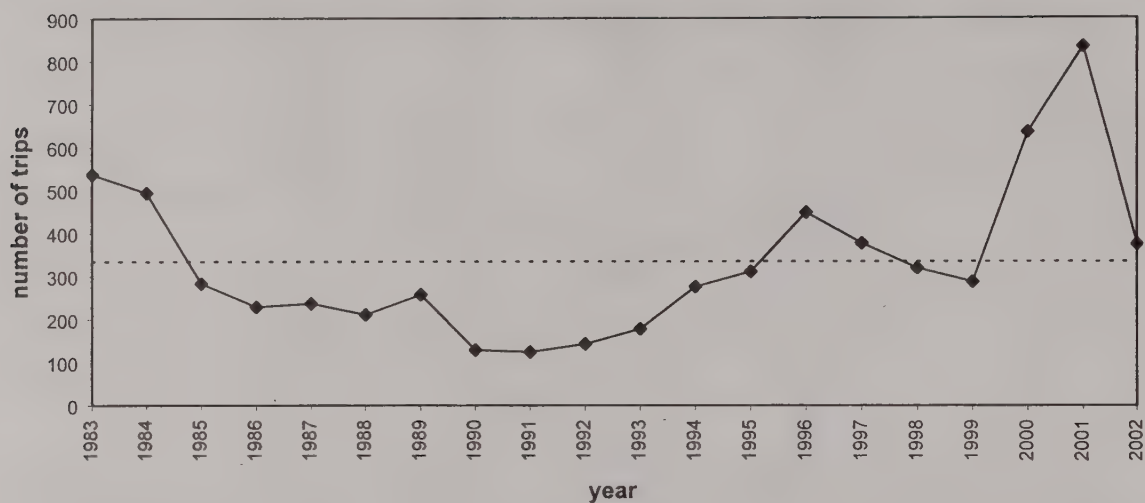
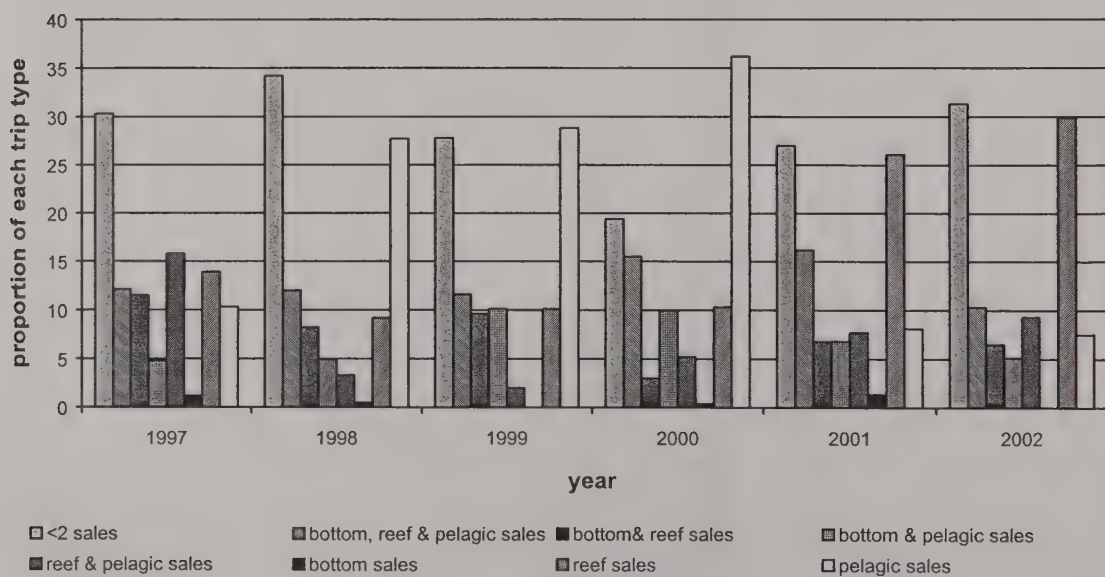


Figure 7.—Types of sales made by fishermen (based on the types of sales made by each fisherman as a proportion of the total number of fishermen).



Interpretation: The number of bottomfish trips was high from 1983 through 1989 as a result of consistent fishing activity centered on the island of Farallon de Medinilla. This fishery subsequently largely ceased in 1990, resulting in a drop in bottomfish trips in the early 1990s. In 1994, consistent fishing activity in the northern islands began once more and has continued to the present. The number of bottomfish trips more than doubled in 2000 and 2001 to reach the highest levels in the 20 years. During this time, more of the smaller vessels increased their focus on reef fishes, and although bottomfishes were still being caught and sold, they were no longer the largest (or most valuable) part of the catch. This resulted in fishermen catching bottomfishes as co-lateral catch on more trips. The number of trips decreased in 2002, to near the 20-year mean, probably as a result of fewer fishermen focusing on catching bottomfishes at all.

The percentage of fishermen that incorporated bottomfishes into their sales was lower in 2002 across all categories (fishermen that sold bottomfish, reef fish and pelagics [BRP], bottomfishes and reef fishes [BR], bottomfishes and pelagics [BP]) and was lower than the 5-year mean in all categories. No fishermen exclusively sold bottomfishes in 2002. In contrast, the percentage of fishermen selling reef fishes (as reef fishes and pelagics [RP] and reef fishes alone [R]) increased in 2002 to greater than the 5-year mean. The percentage of fishermen exclusively selling pelagics (P) also decreased in 2002 to below the 5-year mean. Note that there were also a greater number of fishermen that only made 1 or 2 sales in 2002 than in the previous 3 years.

Calculation: Adding each recorded fisherman's sales on a given day tallies the number of trips that resulted in landing any bottomfish. This assumes that each fisherman lands only once in a given day, and that all of the catch is sold on that day. Most trips last a single day, but it is also known that the occurrence of longer fishing trips is increasing. In addition, many fishermen are no longer selling the bulk of their catch immediately after returning to the island. Fishermen are often pooling their catch with other fishermen before selling them to buyers, as well as freezing all or part of their catch to sell as a multi-trip aggregate at a later date. Both of these actions will cause this measure of trips to underestimate the fishing effort tallied here as "trips." For any individual fisherman that made more than 2 sales in a given year, the type of sales was tallied for each fisherman. These were then summed and divided by the number of fishermen to result in the percentage of fishermen making each type of sales in a given year.

Table 7.—Number of bottomfishing trips.

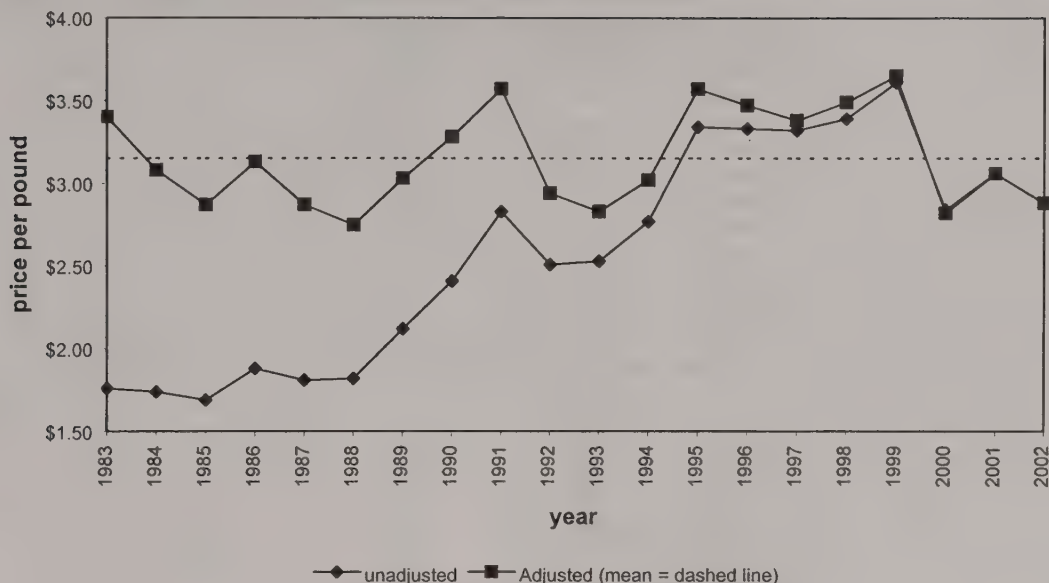
year	trips
1983	536
1984	493
1985	283
1986	229
1987	237
1988	211
1989	257
1990	129
1991	124
1992	143
1993	178
1994	276
1995	311
1996	448
1997	376
1998	319
1999	287
2000	635
2001	834
2002	374
mean	334
standard deviation	181

Table 8.—Percentage of fishermen making various types of sales in a given year.

year	≤2 sales	BRP*	BR	BP	RP	B	R	P
1997	30.3	12.1	11.5	4.8	15.8	12.1	13.9	10.3
1998	34.2	12.0	8.2	4.9	3.3	0.5	9.2	27.7
1999	27.8	11.6	9.6	10.1	2.0	0.0	10.1	28.8
2000	19.4	15.5	3.0	9.9	5.2	0.4	10.3	36.2
2001	27.0	16.2	6.8	6.8	7.7	1.4	26.1	8.1
2002	31.3	10.3	6.5	5.1	9.3	0.0	29.9	7.5
mean	28.3	13.0	7.6	6.9	7.2	0.6	16.6	19.8
standard deviation	5.1	2.4	2.9	2.5	5.0	0.6	9.1	12.6

*BRP—bottom, reef, & pelagic fishes, BR—bottom & reef fishes, BP—bottom & pelagic fishes, RP—reef & pelagic fishes, B—bottomfishes, R—reef fishes, and P—pelagic fishes.

Figure 8.—Average price of bottomfish.



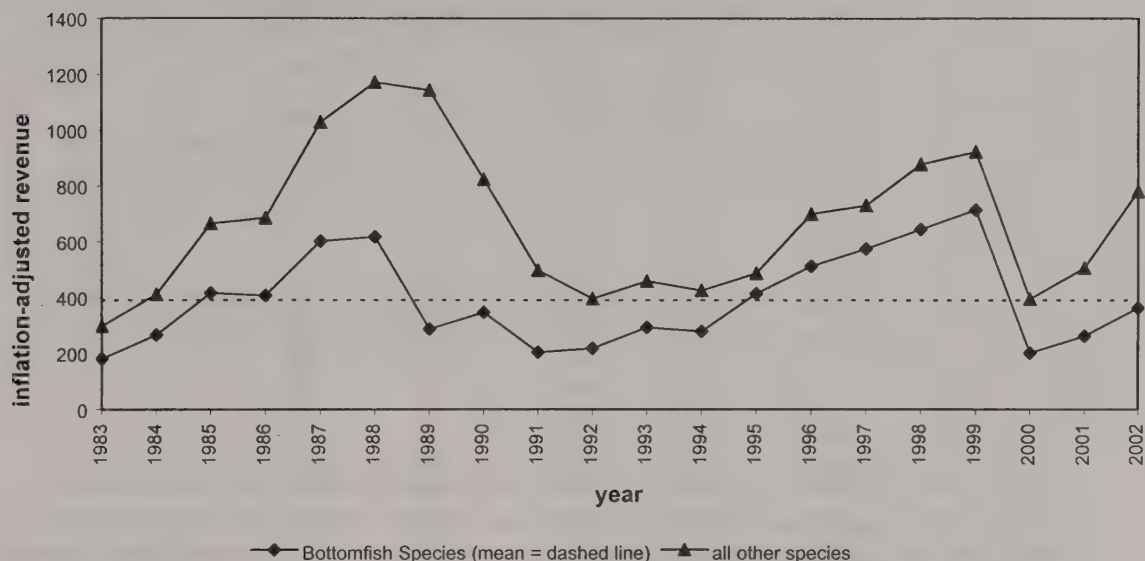
Interpretation: The unadjusted average price increased steadily from 1988 to 1991, where it reached what was once a record high of \$2.83. In 1995, the price increased to a new record high of \$3.34. This unadjusted price remained essentially constant through 1997, increased to \$3.39 in 1998, and reached a new record high of \$3.61 in 1999. The adjusted price continued to increase from 1997. Both the unadjusted and adjusted prices fell steeply in 2000, recovered slightly in 2001, but fell again in 2002. Other than the drop in 2000, the unadjusted and adjusted prices in 2002 were the lowest since 1993. The unadjusted price is slightly higher than the 20-yr mean. The adjusted price was 27¢ lower than the 20-yr mean, and 18¢ lower than last year. Only 5 years in the last 20 have had lower adjusted price values. Bottomfishes are not commanding the high prices they once did.

Calculation: The average price for bottomfish is calculated by dividing the total revenue by the total landings. (Note that the landings and revenues values are both inflated by 20% to represent the CNMI as a whole [assuming a 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].) The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years' prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam's annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Table 9.—Unadjusted and adjusted average price per pound for bottomfishes.

year	unadjusted \$/lb	adjusted \$/lb
1983	1.76	3.40
1984	1.74	3.08
1985	1.69	2.87
1986	1.88	3.13
1987	1.81	2.87
1988	1.82	2.75
1989	2.12	3.03
1990	2.41	3.28
1991	2.83	3.57
1992	2.51	2.94
1993	2.53	2.83
1994	2.77	3.02
1995	3.34	3.57
1996	3.33	3.47
1997	3.32	3.38
1998	3.39	3.49
1999	3.61	3.65
2000	2.84	2.82
2001	3.06	3.06
2002	2.88	2.88
mean	2.58	3.15
standard deviation	0.65	0.29

Figure 9.—Average inflation-adjusted revenue per trip landing bottomfish.



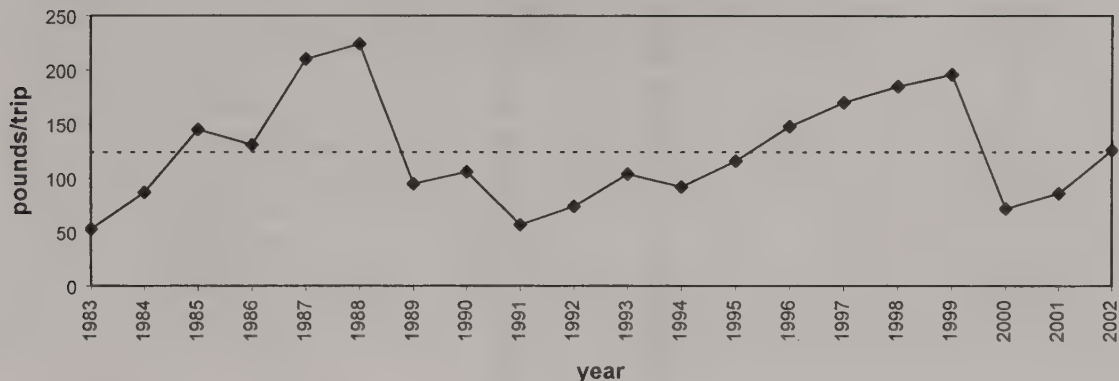
Interpretation: Inflation-adjusted bottomfish and inflation-adjusted all-species revenues both recovered slightly from the marked decrease of 2000. The “bottomfish species” inflation-adjusted revenue recovered to 92.8% of the 20-yr mean adjusted revenue for bottomfishes. At the same time, the “all-species” inflation-adjusted revenue recovered to 16.4% greater than the 20-yr mean. These data may suggest a decadal cycle in abundance (reflected in catch) with peaks in 1987–1989 and 1997–1999. The bottomfish fishery has always been a small proportion of the total fisheries, and it appears that bottomfish are now a relatively lower percentage of the trip revenue on trips where bottomfish were caught.

Calculation: Only trips that landed bottomfish are included in these calculations. “Bottomfish revenue/trip” is the total revenue of the bottomfish sold from a trip, and “all species revenue/trip” is the total trip revenue of all other species combined (e.g., any pelagic and reef fish that were sold). (Note that the revenues values are inflated by 20% to represent the CNMI as a whole [assuming 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].) The inflation adjustment is made using the Consumer Price Index (CPI) and establishing the 2002 CPI figure as the basis by which calculations of previous years’ prices are made. The CPIs for 1983–1987 were not available from the CNMI Department of Commerce and were, therefore, estimated by using Guam’s annual inflation rate to proportionately adjust the 1988 CNMI CPI.

Table 10.—Unadjusted and adjusted revenues for bottomfishes and for all other species sold commercially.

year	bottomfish species		all other species	
	unadjusted	adjusted	unadjusted	adjusted
1983	94	181	154	297
1984	150	266	233	412
1985	245	417	392	666
1986	246	408	413	686
1987	379	603	647	1029
1988	409	618	776	1172
1989	201	287	799	1143
1990	255	347	606	824
1991	162	204	395	498
1992	186	218	339	397
1993	262	293	411	460
1994	256	279	391	426
1995	388	415	456	488
1996	494	514	674	701
1997	565	576	717	731
1998	627	646	852	878
1999	708	715	914	923
2000	204	202	400	396
2001	263	263	508	508
2002	363	363	781	781
mean	323	391	543	671
standard deviation	163	163	211	255

Figure 10.—Bottomfish catch in average pounds per trip.



Interpretation: The substantial increase since the low in 1991 can be primarily attributed to the northern islands fishery, coincident with the increase in vessels making bottomfish trips, increased revenues, and annual landings during the next 8 years. The average pounds of bottomfish landed per trip in 2000 decreased 63.1% from 1999, and recovered slightly in 2001. The recovery continued in 2002, with fewer fishermen selling bottomfishes (such that the average catch per trip increased) to just over the 20-year mean.

Although the average catch per trip is not a very good measure of CPUE, because it is subject to significant biases (e.g., changes in trip length and relative amounts of bottom fishing compared to trolling or reef fishing); it is the only measure readily obtained from the commercial landings system. However, the smaller vessels commonly make mixed trips and the relative proportions of bottom fishes to pelagic and reef fishes are changing. Given that fishermen are changing the focus of their trips to include more reef fishing and less bottom fishing, this measure is an increasingly inaccurate portrayal of the actual CPUE. It has been suggested that it may be possible to improve this measure of CPUE by using only those trips that landed bottomfish exclusively. However, in the past 5 years only 2 fishermen exclusively sold bottomfishes in 1997, 1 in 1998, none in 1999, 1 in 2000, 3 in 2001, and none in 2002. These numbers are too low to be indicative of the entire fishery.

Calculation: The average catch per trip is calculated by dividing the total weight of all bottomfish landings by the number of trips that landed bottomfish, regardless of the amount of bottomfish landed on any given trip. (Note that the landings values are inflated by 20% to represent the CNMI as a whole [assuming 90% coverage of the commercial sales on Saipan and that Saipan is 90% of the market, D. Hamm, pers. comm. 2002].)

Table 11.—Average number of pounds landed per “trip.”

year	pounds/trip
1983	53
1984	87
1985	145
1986	131
1987	210
1988	224
1989	95
1990	106
1991	57
1992	74
1993	104
1994	92
1995	116
1996	148
1997	170
1998	185
1999	196
2000	72
2001	86
2002	126
mean	124
standard deviation	51

Table 12.—Bycatch during bottomfishing (totals for 3 years)

sector	species	total number of interviews	number of interviews with bycatch	number released alive	total number taken	% with bycatch
non-charter		82	1			1.22
	black jack			1	25	4.00
	dogtooth tuna			1	5	20.00
	all species			2	2147	0.09
charter		27	5			18.52
	jobfish			1	2	50.00
	blacktip grouper			4	50	8.00
	lyretail grouper			5	6	83.33
	red snapper			4	5	80.00
	redgill emperor			6	94	6.38
	triggerfish			14	39	35.90
	all species			34	506	6.72

Table 13.—Bycatch during bottomfishing (2002)

sector	species	total number of interviews	number of interviews with bycatch	number released alive	total number taken	% with bycatch
non-charter		27	0			0.00
charter		12	2			16.67
	triggerfish			14	17	82.35
	all species			14	181	7.73

Interpretation: Almost all fishes caught in the CNMI are considered food fishes, including many that show a high incidence of ciguatera locally, including lyretail grouper (*Variola louti*) and red snapper (*Lutjanus bohar*). Above are all the data collected during 3 years (2000–2002) of interviews of fishermen during boat-based creel surveys. Table 4 shows the entire reported bycatch during bottomfishing for 2002. The interviews are divided into vessels engaged in non-charter (including commercial, non-commercial, and subsistence fishermen) and charter fishing. The charter fishing sector largely caters to the tourist population, of which the majority is Japanese. This sector targets blacktip grouper (*Epinephelus fasciatus*) and redgill emperor (*Lethrinus rubrioperculatus*). Catch rates in this sector must remain high to ensure that the clientele are satisfied with the charter. For this reason, small fishes are often released alive, so that they may be recaptured on subsequent charters. All bycatch, in both sectors, was released alive.

Appendix 5

GLOSSARY

<u>TERM</u>	<u>DEFINITION</u>
Alia	Samoan fishing catamaran, about 30 feet long, constructed of aluminum or wood with fiberglass. Used for various fisheries including trolling, longline, and bottomfishing
AP	Advisory Panel. Appointed industry/government/educational representatives functioning in an advisory capacity to the Council.
Armorhead	Groundfish found on the SE Hancock Seamount in the Northwestern Hawaiian Islands
AS or American Samoa	Includes the islands of Tutuila, Manua, Rose and Swains Atolls.
ASDPW	Department of Public Works, American Samoa. Also, DPW.
BARB	Bottomfish Advisory Review Board
BMUS	Bottomfish Management Unit Species, include deep and shallow water bottomfish species
BPT or PT	Bottomfish Plan Team. Advisory body to the Council composed of scientists and fishermen who monitor and manage the fisheries under the jurisdiction of the Bottomfish and Seamount Groundfish FMP.
Bycatch	Fish caught in a fishery but discarded or released, except in a recreational fisheries catch and release program.
Commercial	Commercial fishing, where the catch is intended to be sold, bartered, or traded.
CNMI or the Commonwealth of the Northern Mariana Islands	Also, Northern Mariana Islands, Northern Marianas, and NMI. Includes the islands of Saipan, Tinian, Rota, and many others in the Marianas Archipelago.
CPUE	Catch-Per-Unit-Effort. A standard fisheries index usually expressed as numbers of fish caught per unit of gear per unit of time, eg., number of fish per hook per line-hour or number of fish per 1,000 hooks. The term catch rate is sometimes used when data are insufficiently detailed to calculate an accurate CPUE.
DAWR	Division of Aquatic & Wildlife Resources, Territory of Guam.
DBEDT	Department of Business, Economic Development & Tourism, State of Hawaii.

DFW	Division of Fish & Wildlife, Northern Mariana Islands.
DLNR	Department of Land & Natural Resources, State of Hawaii.
DMWR	Department of Marine & Wildlife Resources, American Samoa. Also, MWR.
EEZ	Exclusive Economic Zone, refers to the sovereign waters of a nation, recognized internationally under the United Nations Convention on the Law of the Sea as extending out 200 nautical miles from shore. Within the U.S., the EEZ typically is between three and 200 nautical miles from shore.
ESA	Endangered Species Act. An Act of Congress passed in 1966 that establishes a federal program to protect species of animals whose survival is threatened by habitat destruction, overutilization, disease etc.
FAD	Fish Aggregating Device; a raft or pontoon, usually tethered, and under which, pelagic fish will concentrate.
FDCC	Fishery Data Coordinating Committee, WPRFMC.
FFA	Forum Fisheries Agency. An agency of the South Pacific Forum, which comprises the independent island states of the South Pacific, Australia and New Zealand. The FFA formed to negotiated access agreements between FFA member countries and distant water fishing nations such as Japan and the USA.
FMP	Fishery Management Plan.
GU or Guam	A U.S. territory in the Marianas Archipelago. South of and adjacent to the Commonwealth of Northern Marianas Islands.
HI or Hawaii	U.S. state. See MHI, NWHI. Composed of the islands, atolls and reefs of the Hawaiian Archipelago from Hawai'i to Kure Atoll, except Midway Islands. Capitol - Honolulu.
HDAR	Hawaii Division of Aquatic Resources. Also, DAR.
HIMB	Hawaii Institute of Marine Biology, University of Hawaii.
Hoomalu Zone	Limited entry bottomfish management area located in the northwestern Hawaiian Islands, includes area from French Frigate Shoals to Kure atoll, including Hancock seamount.
Incidental Catch	Fish caught that are retained in whole or part, though not necessarily the targeted species. Examples include monchong, opah and sharks.
Interaction	Catch of protected species, which is required to be released. Examples: Hawaiian monk seals, marine turtles and albatrosses.
Logbook	Journal kept by fishing vessels for each fishing trip; records catch data,

Mau Zone	Limited entry bottomfish management area located north of Kauai to Necker Island at 165° W.
MFCMA	Magnuson Fishery Conservation and Management Act of 1976. Also, Magnuson-Stevens Fishery Conservation and Management Act of 1996. Sustainable Fisheries Act.
MHI	Main Hawaiian Islands (comprising the islands of Hawai'i, Mau'i, Lana'i, Moloka'i, Kaho'olawe, O'ahu, Kauai', Ni'ihau and Ka'ula).
MSY	Maximum Sustainable Yield.
NMFS	National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Department of Commerce. Also NOAA Fisheries.
NOAA	National Oceanic and Atmospheric Administration, Department of Commerce.
NWHI	Northwestern Hawaiian Islands. All islands in the Hawaiian Archipelago, other than the Main Hawaiian Islands (MHI).
OY	Optimum Yield.
PIAO	Pacific Islands Area Office, National Marine Fisheries Service. Also, NMFS/PIAO.
Protected	Refers to species which are protected by federal legislation such as the Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act. Examples: Black-footed and Laysan albatrosses, marine turtles, dolphins.
Recreational	Recreational fishing for sport or pleasure, where the catch is not sold, bartered or traded.
SAFE	Stock Assessment and Fishery Evaluation, NMFS.
Sanctuary	Protected area. Commercial/recreational fishing may be restricted.
Secretary	When capitalized and used in reference to fisheries within the U.S. EEZs, it refers to the U. S. Secretary of Commerce.
SPC	Secretariat of the Pacific Community. A technical assistance organization comprising the independent island states of the tropical Pacific Ocean, dependant territories and the metropolitan countries of Australia, New Zealand, USA, France and Britain.
SPR	Spawning Potential Ratio. A term for a method to measure the effects of fishing pressure on a stock by expressing the spawning potential of the fished biomass as a percentage of the unfished virgin spawning biomass. Stocks are deemed to be overfished when the $SPR < 20\%$.
SSC	Scientific & Statistical Committee, an advisory body to the Council

Trolling	Fishing by towing lines with lures or live-bait from a moving vessel.
USCG	U.S. Coast Guard, 14 th District, Department of Transportation.
USFWS	U.S. Fish & Wildlife Service, Department of Interior. Also, FWS.
VMS	Vessel Monitoring System. A satellite based system for locating and tracking fishing vessels. Fishing vessels carry a transponder which can be located by overhead satellites. Two-way communication is also possible via most VMS systems.
WPacFIN	Western Pacific Fishery Information Network, NMFS.
WPRFMC	Also, the Council. Western Pacific Regional Fishery Management Council. One of eight nationwide fishery management bodies created by the Magnuson Fisheries Conservation and Management Act of 1976 to develop and manage domestic fisheries in the U.S. EEZ. Composed of American Samoa, Guam, Hawaii, and Commonwealth of Northern Mariana Islands.

